Engineering News-Record

A Consolidation of Engineering News and Engineering Record
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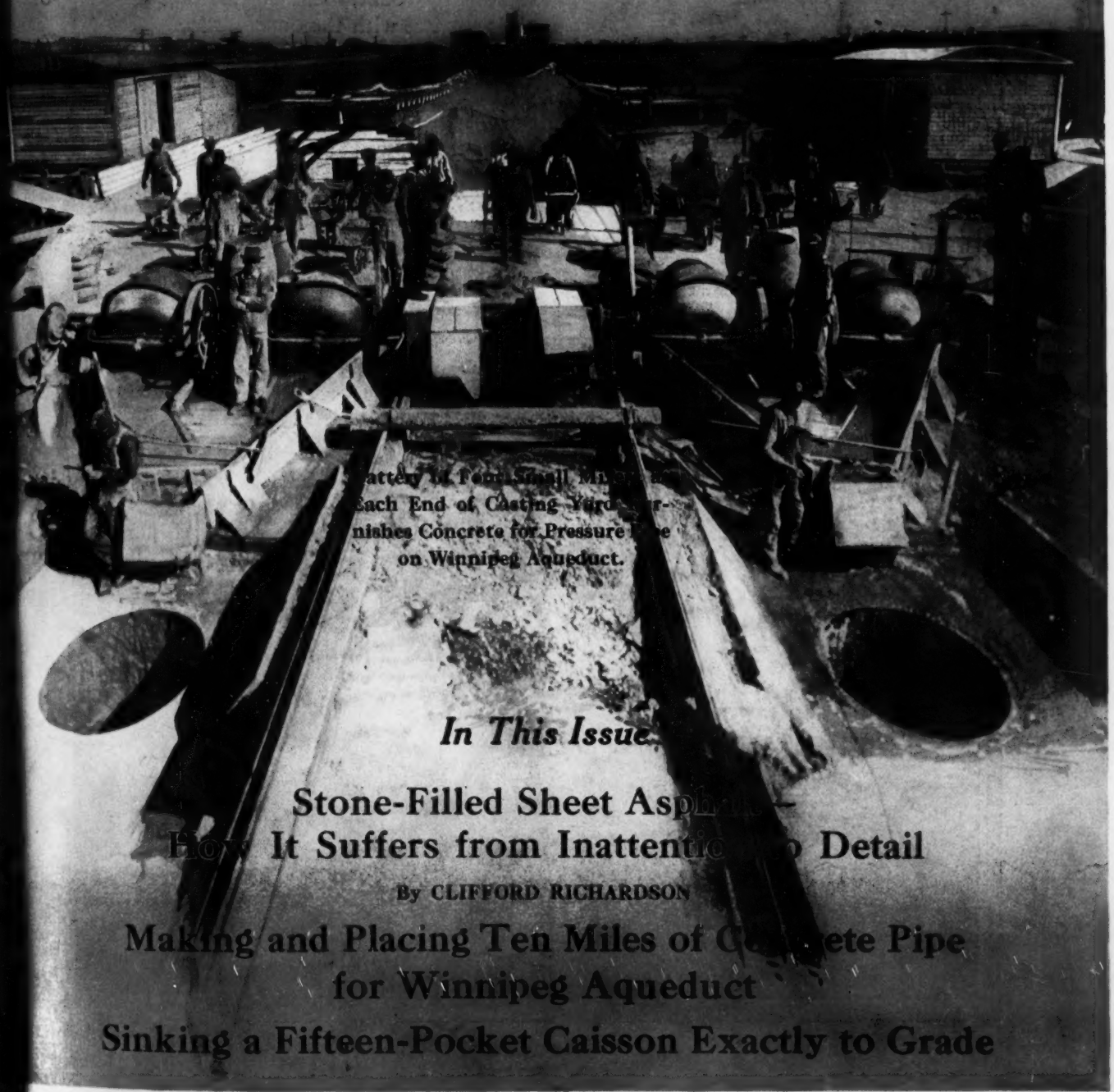

Battery of Four Small Mixers at Each End of Casting Yard Furnishes Concrete for Pressure Pipe on Winnipeg Aqueduct.

In This Issue

Stone-Filled Sheet Asphalt—
How It Suffers from Inattention to Detail
By CLIFFORD RICHARDSON

Making and Placing Ten Miles of Concrete Pipe for Winnipeg Aqueduct

Sinking a Fifteen-Pocket Caisson Exactly to Grade

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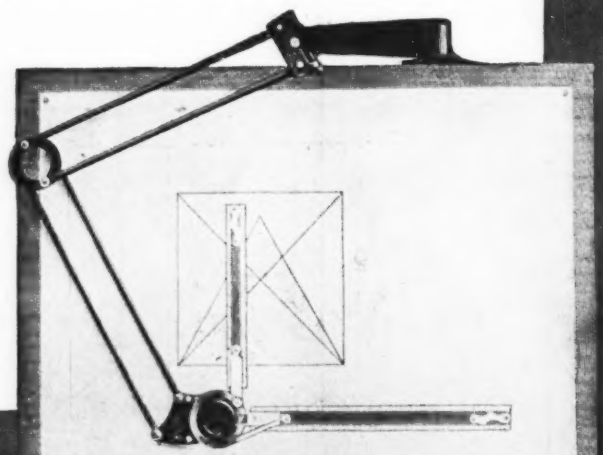
The Universal Drafting Machine is an important aid in this emergency. It conserves fully 50% of the draftsmen's time. You will be interested in the descriptive catalog showing its scope. Write for your copy today.



The accompanying view of Stone & Webster drafting room, shows some of the full equipment of Universal Drafting Machines used by this company.

UNIVERSAL DRAFTING MACHINE COMPANY
Cleveland, Ohio, U. S. A.

A Consolidation of Engineering News and Engineering Record — McGraw-Hill Company, Inc.—JAMES H. MCGRAW, President

ENGINEERING NEWS-RECORD

A WEEKLY JOURNAL
DEVOTED TO CIVIL ENGINEERING
AND CONTRACTING

Volume 80 — NEW YORK, THURSDAY, JANUARY 17, 1918 — Number 4

War a Destroyer of Inertia and Prejudice

ONE of the many interesting phenomena of the war is the ready acceptance under its pressure of ideas hitherto making slow progress against inertia and prejudice. For example, far-sighted men have long realized the value of detailed instruction to workers, of a brief but intensive training period, of fitting workers to tasks, of having regard for psychological factors. The application of all these ideas, though, made slow progress. Now at a moment they receive wide acceptance. Necessity has forced action and has forced prejudice aside. The specialized training of war cripples, reported in this journal some weeks ago, and the training of women for industry, discussed on page 69 of the last issue, are instances of the accelerated progress due to the war. In various war industries short training courses—vestibule shops or schools, they have been called—have been established. The methods will undoubtedly persist after the war to the benefit of all concerned—the worker, the public, the industry.

The First Large Concrete Ship

ON PAGE 105 and in the supplement accompanying this issue will be found information relating to the first 5000-ton concrete ship. At present only pictorial description is permissible, but the venture is so novel, the step so great, that these views will hold the greatest interest for engineers and contractors. Particularly will this ship appeal to the readers of this journal, for it is they—the civil engineers and contractors—who have developed the use of reinforced concrete and made possible the achievement represented by the big boat now on the ways at San Francisco. The presentation of these views would not be complete were they not accompanied by a word of appreciation for the courage displayed by the men who initiated and have backed this enterprise. Themselves not shipbuilders, they have stood sponsor for an experiment of exceptional proportions. When they initiated their work, the only precedent was a barge of a few hundred tons capacity. Even now no real concrete ship is afloat, and the nearest competitor on the ways runs to only 1600 tons. To W. Leslie Comyn, president of the San Francisco Shipbuilding Co., chief credit is due. His was the faith that carried the enterprise through the stage of financing, when the project was considered impossible, and his "mud ship" and "brick ship" was made the subject of many a thrust. His faith and courage have continued undiminished despite the trials incident to a revolutionary development. The final stage of the enterprise has not been reached—the service test—but as the ship has grown, the designs become completed, there has been an increased confidence on the part of all—technical advisers, both marine and structural, as well as owners. The engineering public will look on with hope and faith and generous wishes for complete success.

More Water Capacity and Less Water Waste

A SINGLE water-supply conduit from a distant source with only a few days' storage capacity at the city end of the conduit places a city in a condition of constant danger of water famine. The danger increases as the daily consumption approaches the conduit capacity and doubles or trebles at extremes of heat and cold. A case in point was Jersey City during the recent week of zero weather. Luckily no great conflagration broke out, but railway traffic on two important lines was demoralized for several days. Presumably there was also much interference with other industries and with the comfort and convenience if not the health of thousands of citizens. Perhaps the incident will hasten plans already well under way for duplicating the water-supply conduit from the Boonton reservoir to Jersey City. Should it not also lead to an immediate extension of the meter system? Such a course would not only cut waste but would also place its burden on those responsible for it. A drive on water meters, combined with an auxiliary water-supply by contract, just proposed, might enable Jersey City to postpone the duplication of its conduit for several years, thus saving the city excess war prices and releasing funds, material and labor to help win the war.

Ministry of Munitions Is Not Favored by President

THE report, made on high authority, that President Wilson does not favor the establishment at this juncture of a Ministry of Munitions to take over all the work of the purchasing organizations of the War and Navy Departments implies that the readjustments made as a result of recent Congressional investigations are expected to solve the problem. As, in the last analysis, the creation by legislative enactment of a Ministry of Munitions would be equivalent to giving the President an extra cabinet member, it is believed that the objection of the President, who is the one person to be consulted in the matter of adding a new member to his official family, will definitely put an end

to the project. Evidently the recent reorganizations, which include the creation of a war council by the Secretary of War and the calling in of men of large experience and executive ability, such as General Goethals, are relied upon by the President to solve such difficulties as have been brought to light in the recent investigation of various bureaus in the War Department. Of course, no public dissatisfaction has been expressed over the work of the Bureau of Supplies and Accounts in the Navy Department, which is generally credited with having done excellently in providing for the great increases that have taken place in that branch of the service. The manufacturing public can count with confidence, therefore, on the continuance of their existing relations with present purchasing agencies of the Government.

Taking Counsel on Purchasing

IN THE news pages of this issue will be found a Washington report regarding the prospective reorganization of the purchasing methods of the War Department. The problem is so many-sided and will have so important an influence on the army and on the country's industries that the policy to be determined should be given most careful consideration. The Senate Committee on Military Affairs already has much information regarding methods thus far employed. It will get more. It hears, however, from those who have been responsible for the present system. It would be well before the constructive work is undertaken to take counsel of those who have had a broad purchasing experience and who have not been connected hitherto with the war purchasing. General Goethals is among those who should be able to render assistance. The purchasing for the canal was of large proportions and was efficiently handled. The General has had no connection with war purchasing and is now engaged on the task of reorganizing the Quartermaster's Department. In that work the deficiencies of the present system are sure to become clear to him. The Senate committee might well take counsel of General Goethals' experience.

The 10 Per Cent. Profit Specter

IN HIS testimony before the Senate Committee on Military Affairs the Secretary of War stated that the cantonments had been built at a profit to the contractors of 2.98 per cent. The statement should help to lay the specter of "cost plus *10 per cent.*" which still seems to haunt the public in their thinking about the cantonments. It is true that on the small contracts—less than $100,000—the fee was, and still is, 10 per cent. The rate of profit then decreases as the cost of the work increases, 6 per cent. being the return on jobs costing over $3,500,000, with the stipulation that the maximum fee, no matter how large the contract, be not over $250,000. The size of the contracts was such, however, (the sixteen national army cantonments were built at a cost of $134,000,000) that the average profit was brought down to the percentage stated by the Secretary. In one contract, over $3,500,000 but much under the maximum, that has come to this journal's attention, another factor—the war profits tax—has cut in heavily and will bring back to the Government between $100,000 and $130,000 of the $250,000 fee it paid the contractor. Of course there was inefficiency in some of the cantonment construction. That was inevitable, though none the less regretable, under the circumstances. Moreover, the cost plus fixed fee form of contract would avoid the criticism that has been leveled at the cost plus a percentage for profit. Nevertheless, the facts should be recognized—the returns to the contractors were not abnormal, and they did not, as has been baselessly charged, have any interest in promoting inefficiency, whatever may have been the desire of unpatriotic, time-serving foremen and workers under them.

Shipping the Controlling Factor in Our Production Program

VARIOUS efforts are being made to fit labor supply to labor demand. In the enlisted personnel of the army there has been made a census of the men's experience. For other Government operations, public and private, many plans are being used to get the required workers.

Careful canvass of the methods discloses lack not only of comprehension of the problem, but of intelligent methods of labor management. This indictment applies as of the divisions or departments individually and to the war machine as a whole. Each "procurement" division is now a law unto itself. It is intent on its program; it cares not about the troubles of others. The railroads broke down under a priority scheme of this kind: my goods are to be shipped—the devil take care of the rest. Much the same is the situation regarding labor.

If the available labor is to be used intelligently the whole war activity back of the lines must be regarded as *one production program.* The parts must fit into one scheme. There must be coöperation, one centralized intelligence. We do not say centralized control. That is not feasible with the present war machine, nor is it necessary. A centralized intelligence will serve.

Even centralized intelligence will not avail, unless the problem be correctly analyzed. The key to the entire situation is shipping. At present we have not enough carrying capacity to take the goods that the factories are turning out. Mountains of freight are at the seaboard and congestion extends well inland. If we stimulate production still more that condition will become so aggravated that factories will have to go on part time or shut down. That means disorganization of forces recruited at great expense, labor dissatisfaction and probably *serious, very serious trouble.*

Shipping therefore determines the volume of contracts that should be let and the rate at which they should be prosecuted. Volume and rate determine the quantity of labor required.

Manifestly, then, there is needed in each procurement division schedules which show the tonnage to be delivered to seaboard. These division schedules, centralized, make a national schedule, which must be balanced against shipping capacity. If production exceeds shipping, production will be cut down to fit. If cargo space is in excess, production will be increased. Consideration will be given in such a plan to the feasibility of

piling up supplies as against a possible time of cargo capacity greatly in excess of the weekly production.

Schedules being adjusted to shipping, the handling of labor is possible on a sound basis.

Most plants *use* from two to ten times as much labor as they *need*. In other words their labor turnover is from two hundred to one thousand per cent. Their shortage is not in labor but in managerial sense and ability. Their cry for more labor is to be met not with additional workers but with help in management.

In addition, therefore, to offices in each procurement division which will centralize schedules there is need for equally careful record of the labor situation. Schedule and labor officials from each division coming together in a centralizing committee would quickly work out production in a way to use the available labor to the best advantage, insure the use of cargo space as it became available and prevent what is now threatening, even worse seaboard congestion.

The plan is simple. In that lies its merit. It, or some similar comprehensive plan, must prevail, or we shall continue to bungle. Various departments are working on the problem. The Ordnance Department is making good progress on the essential work—production schedules and intelligent labor handling. The Secretary of War is in a position to apply the ideas, through the War Industries Board, to all War Department activities. Once the production and labor features are centralized in the War Department the navy could quickly fit its plans into the general scheme, while the Department of Labor would obviously act as an over all agency and use its administrative machinery as it would prove applicable. The Shipping Board necessarily is a vital factor in the plan. Its place in the scheme is self evident.

Help Save Our Boys—They Must Have Big Guns!

Heavy machine tools must be had at once—in large numbers. There is no time for the Government to have them built. If our boys in France are to get weapons to fight with, we must take these tools from peaceful industries to make the weapons.

The machines needed are:

60 x 60 x 20-ft. planing machines.
48 x 48 x 20-ft. planing machines.
36 x 36 x 14-ft. planing machines.
Nos. 4 and 5 plain milling machines.
Nos. 4 and 5 vertical milling machines.
30-in. x 20-ft. engine lathes.
36-in. x 20-ft. engine lathes.
4- and 5-ft. radial drilling machines.
18 x 130-in. cylindrical grinding machines.
10-ft. vertical boring mills.
5-ft. vertical boring mills.
6-in. floor type, horizontal boring and milling machines.
4-in. floor type, horizontal boring and milling machines.

Are any of these machines in your plant?

If so, arrange to do without them from the earliest possible date—the Government will buy or rent them.

We cannot win the war without big guns. We cannot make the guns without these tools.

Write or wire the

Machine Tool Section
of the
WAR INDUSTRIES BOARD
COUNCIL OF NATIONAL DEFENSE
Washington, D. C., and do it NOW.

Rapid-Transit Developments and Efficiency in the City

PHILADELPHIA'S success in bringing about an operating partnership between the city and the Philadelphia Rapid Transit Co. is but one element, though a significant one, of a general forward movement in rapid-transit matters in our large cities. That such progress should develop at a moment of maximum national strain, at the entrance into the greatest war year ever known, is surprising. But it appears to be, like the developments in the railway situation, the expression of an effort toward increased service efficiency. We have come to realize at last that efficient transit means as much to the city as efficient freight movement means to the nation. Pittsburgh has just made its first serious step toward urgently needed improvement in city transit. After a year's keen study of the problem, engineers report that two rapid-transit lines should be built, linking up the east end, the Allegheny side and the South Hills district with downtown. In Detroit the pressure of rapid growth has led to the same result. A definite plan has been formulated for the first small step in tying together the distant parts of the city by rapid transit, to free its industrial and commercial life of needless lost motion. And at the same moment a very concrete example of progress is exhibited by New York, in the opening last week of the central part of its most important new subway route, the Broadway line.

At the front of present rapid-transit developments, however, stands the Philadelphia partnership agreement. Its importance lies as much in the new spirit that speaks from it as in the novel, precedent-creating terms of the contract. Community of interest between municipality and operator is explicitly recognized.

Embracing all existing street-car and other transit lines and the new lines which the city is constructing, and arranging both financial and management affairs on a remarkably broadgage basis, the agreement accomplishes two great things for the city. First, all present traffic facilities are mobilized for most efficient and lowest-fare operation immediately, and so soon as the nearly-completed Frankford elevated railway is ready for trains a rapid-transit system of considerable scope comes into being by combining it with the old Market Street line. Second and no less important, wounds of long standing are healed and sound guarantees for the future are given to the taxpayer, as well as to the street-railway investor, by a recognition of the company's present capital obligations coupled with an assured but absolutely limited five per cent. return on

this capital. Under control of a supervisory board of engineers, the method of administration enlists all the power of the state public-service commission and adds still further powers of regulation for the purpose of efficient management.

Thus at one stroke a tangled situation that was a threat against efficiency in transportation within the city is cleared up. All parties in interest have joined hands to give Philadelphia the best transit obtainable. With years of discussion and dispute preceding, the chance of agreement seemed remote; the final success may fairly be credited to sober and purposeful recognition of the fact that now performance is needed rather than words.

The past way of dealing with rapid-transit questions was a go-as-you-please method, with much argument and talk, and few immediate results. The demands of the immediate future are for direct and rational attack on the problems that present themselves. Indications are that the public spirit will support such direct procedure, or rather will render any other impossible. And at the same time the Philadelphia contract will help toward solution of rapid-transit problems by showing a way to efficiency through coöperation.

Consulting "Jobs" that Lower Engineering Standards

FIVE positions, those of consulting engineer to each of the five boroughs of New York City, which, both by reason of the title and of the salary—$7200 per annum—should be given only to men of considerable attainments in the civil engineering profession, have assumed the character of out-and-out political appointments. Recent evidence of this is the giving of one of these posts to a man who is scarcely recognized as an engineer of any sort, and whose chief reputation rests upon his having been removed from office for cause shown when he was president of the Borough of the Bronx in Mayor Gaynor's administration. If offices bearing engineering titles are to be created for the purpose of affording plums to political bosses, it is time that engineers should take cognizance of the fact for the protection of the engineer's public reputation. Agitation should be begun either for the abolition of these offices or for the appointment to them of real engineers.

Can the New York Canals Carry All the Coal the State Needs?

IN AN entirely praiseworthy effort to promote the use of the New York State Barge Canal and incidentally to initiate measures toward providing coal for the state next summer, General Wotherspoon, State Superintendent of Public Works, has made public a plea for the utilization for the State canal system as a carrier for coal. The superintendent points out that Ithaca and Watkins Glen, the most southerly terminals on the canal, are within 120 to 190 miles of both the anthracite and the bituminous centers of Pennsylvania, whence comes practically all of New York State's coal supply and that railway transportation of coal to those canal terminals, to be carried to New York centers by water, would release 18,000 cars per month for service to relieve the coal shortage elsewhere in the country, a shortage which even the coming of the warm weather will not end.

General Wotherspoon figures that the canal's capacity is limited only by the quantity of water utilized in operating the locks. On such a basis, he assumes that five 240-ton boats—a tow filling one of the locks—can pass every half hour in the day, or 57,600 tons each day, and upwards of 12,000,000 tons in the canal season. This is about 75% of the total tonnage of coal now entering New York State by rail. The remaining 25%, he concludes, can be brought to other transshipment points on the canal with some saving of rail haulage, though not as great as that effected by using the most southerly ports.

The only factors preventing such a use of the canals are the lack of boats and terminals. Boats for so dense a traffic, which would amount to a continual day and night procession of tows every two miles along the canal, are admittedly not now all available, but the superintendent rightly says the needed additions could be built with little or no delay.

The loading and unloading of the boats, however, is passed over with the casual sentences: "Terminals are available for service at practically every port of the canal system. They have been or will be equipped with devices for the speedy and economical handling of the traffic. If the coal traffic wants special machinery, it can be provided." In so far as the unloading is concerned, this may be true. No one terminal along the canal will have so great an inflow of coal as to preclude the early construction of suitable handling machinery. But to load at one or even at two ports the estimated 1150 cars per day onto barges will require terminals of mammoth proportions, such as can hardly be provided in time to be of aid in the coming crisis. The Curtis Bay terminal of the Baltimore & Ohio R.R., the largest coal-handling plant in the world, can transfer 7000 tons per hour, or less than three times the estimated speed at the canal loading point. And this railroad terminal cost $3,500,000, exclusive of its extensive yard system, and took two years to build.

No one doubts the availability of the New York canals as coal carriers. No one should criticize the state official for promoting that use of the canals. Far too little publicity has been given the canals in the past. But the superintendent has evidently claimed too much for his carrier in this last statement. He has overlooked in his estimate one of the most important, if not the most important factor in the present congestion of our railways; that is, inadequate terminals. Terminal inadequacy will congest a canal just as surely as it will a railway. The picture of a tow of five 240-ton canal boats full of coal leaving Ithaca and Watkins every hour of the day and night from the first of next April to the first of next November is pleasing, and even conceivable; but it is hard for an engineer to visualize, completed in the next few months, the yards required to bring up that much coal through those two narrow lacustrine valleys and deliver it to dumpers where now there exist only typical canal retaining-wall terminals. Part of the railway congestion of the coal-carrying roads through New York State should certainly be relieved by the canals next summer. Taking over the entire New York traffic is a trifle ambitious.

First Large Concrete Ship Is Building at San Francisco

Vessel Will Have Dead-Weight Carrying Capacity of 5000 Tons, Is 366 Feet Long and Has 45-Foot Beam—First Full Publication of Views

(This article is accompanied by a large inserted supplement)

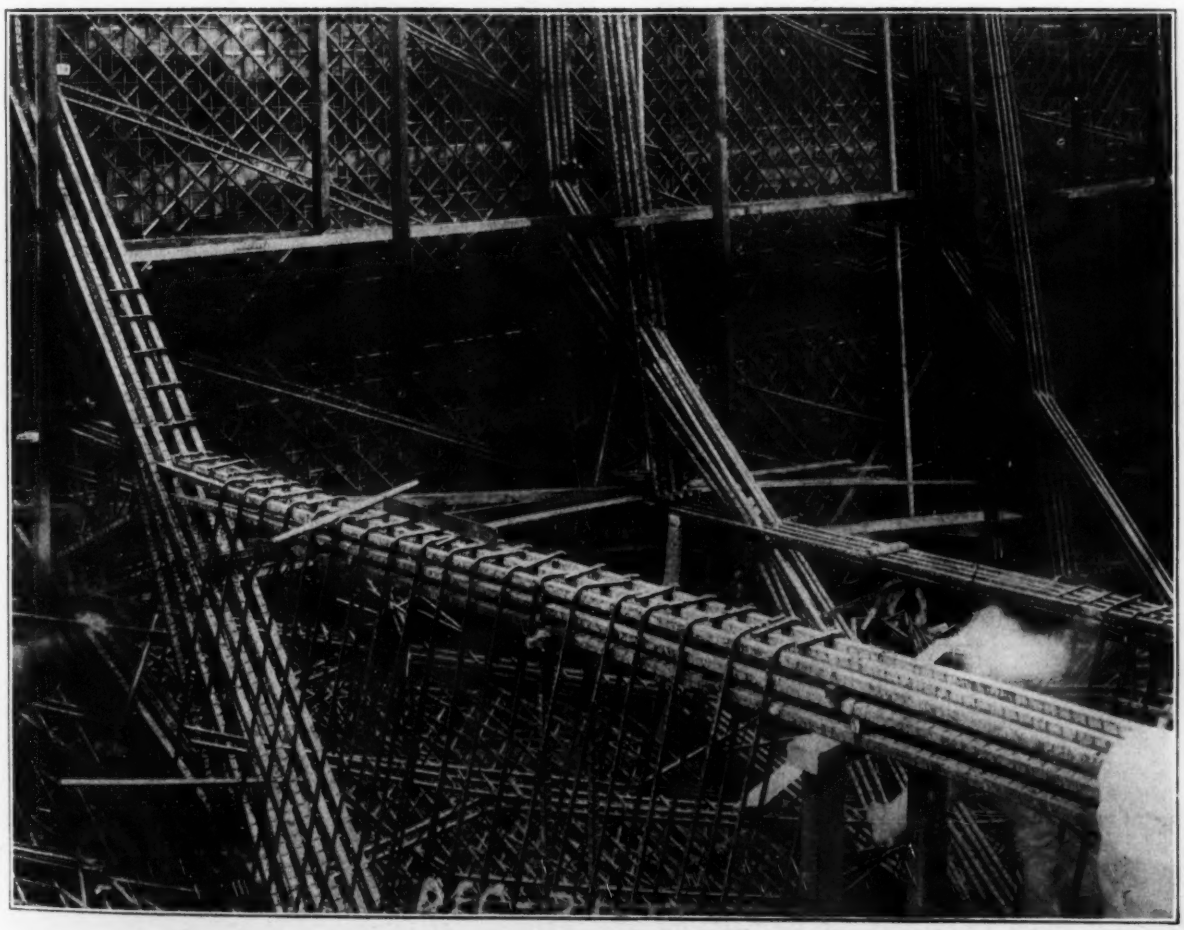
LAST August the San Francisco Shipbuilding Co. began the construction at Redwood City, Calif., at the southern end of San Francisco Bay, of the ways for the construction of a reinforced-concrete ship of 7900 tons displacement, with a dead-weight carrying capacity of 5000 tons. The laying down of the ship was started in September and the vessel will be ready for launching Mar. 1. Had it not been for changes of plans and the employment of a new naval architect, the vessel would likely have been ready for the water Feb. 1. At the present writing, pouring of the concrete in the bottom is under way.

The ship is 336 ft. long over all, 45 ft. in beam, and 31 ft. deep to the upper deck. The draft loaded will be 24 ft. The ship will be equipped with Scotch marine boilers and 1750-hp. triple-expansion engines. The speed will be 10 knots.

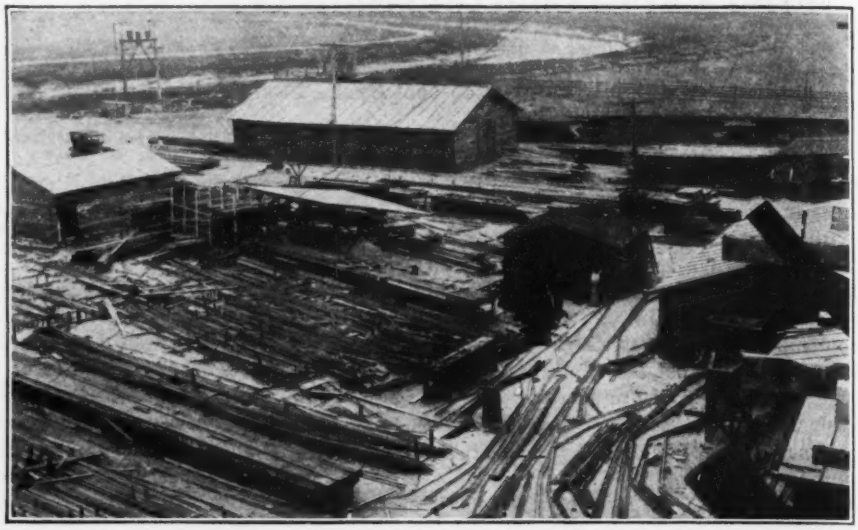
Details of the design of the ship are, for obvious reasons, held confidential for the present, but through the courtesy of W. Leslie Comyn, president of the San Francisco Shipbuilding Co., *Enginering News-Record* is privileged to present here the first adequate pictorial history of the progress of the boat. The general plan of the design is apparent from these illustrations. They give concrete designers and constructors quite a clear idea of the construction problem presented by so complex an engineering structure.

The company now has under way designs for four ships of 7500 tons dead-weight carrying capacity.

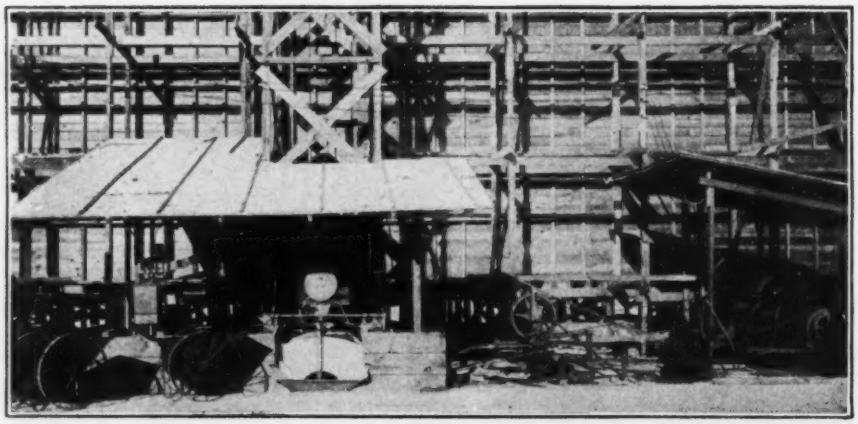
The officers of the company, in addition to Mr. Comyn, are John Lawson, vice-president; George U. Hind, treasurer; R. J. Hanna and J. H. Baxter, directors, all of San Francisco. Allen MacDonald, of MacDonald & Kahn, consulting engineers and contractors, is superintendent of construction; E. L. Stuart, naval architect, and A. Poss, consulting engineer.



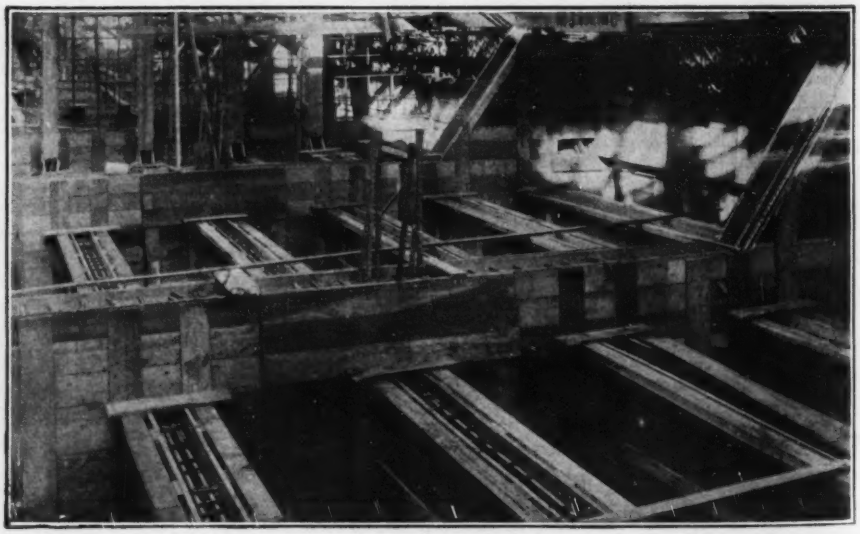
COMPLICATED BIT OF STEELWORK AFT



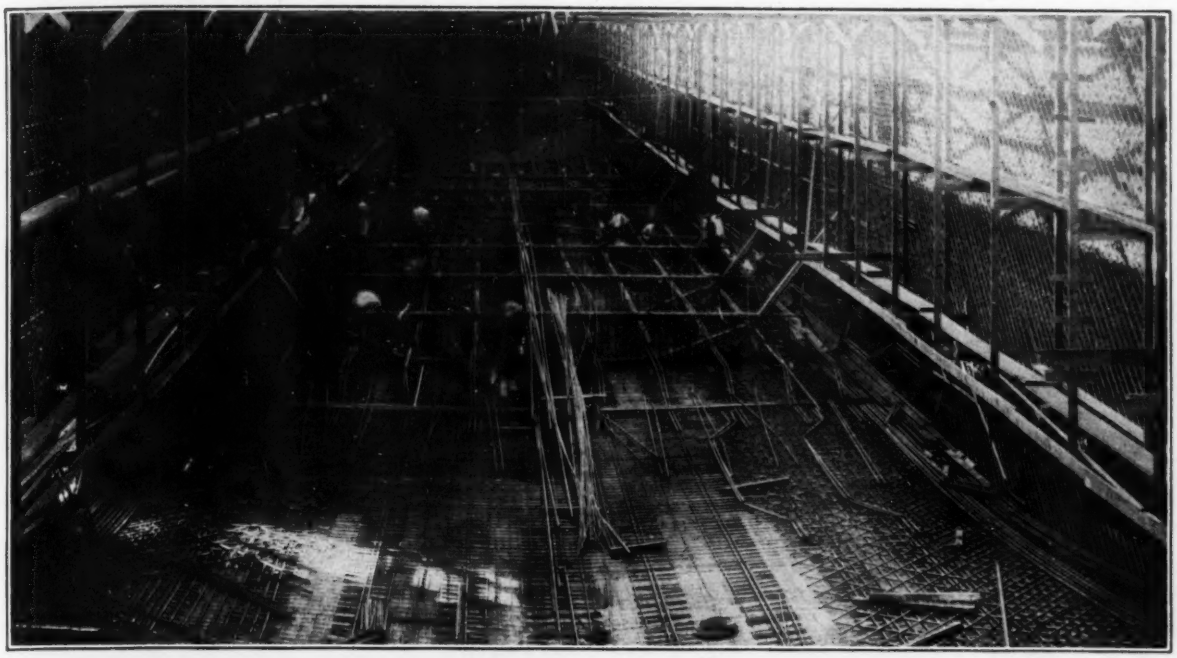
THE TWO UPPER VIEWS ON THIS PAGE SHOW THE WHOLE "PLANT" FOR BUILDING THE CONCRETE SHIP—CONTRAST IT WITH THE LARGE AND EXPENSIVE PLANT REQUIRED IN A STEEL-



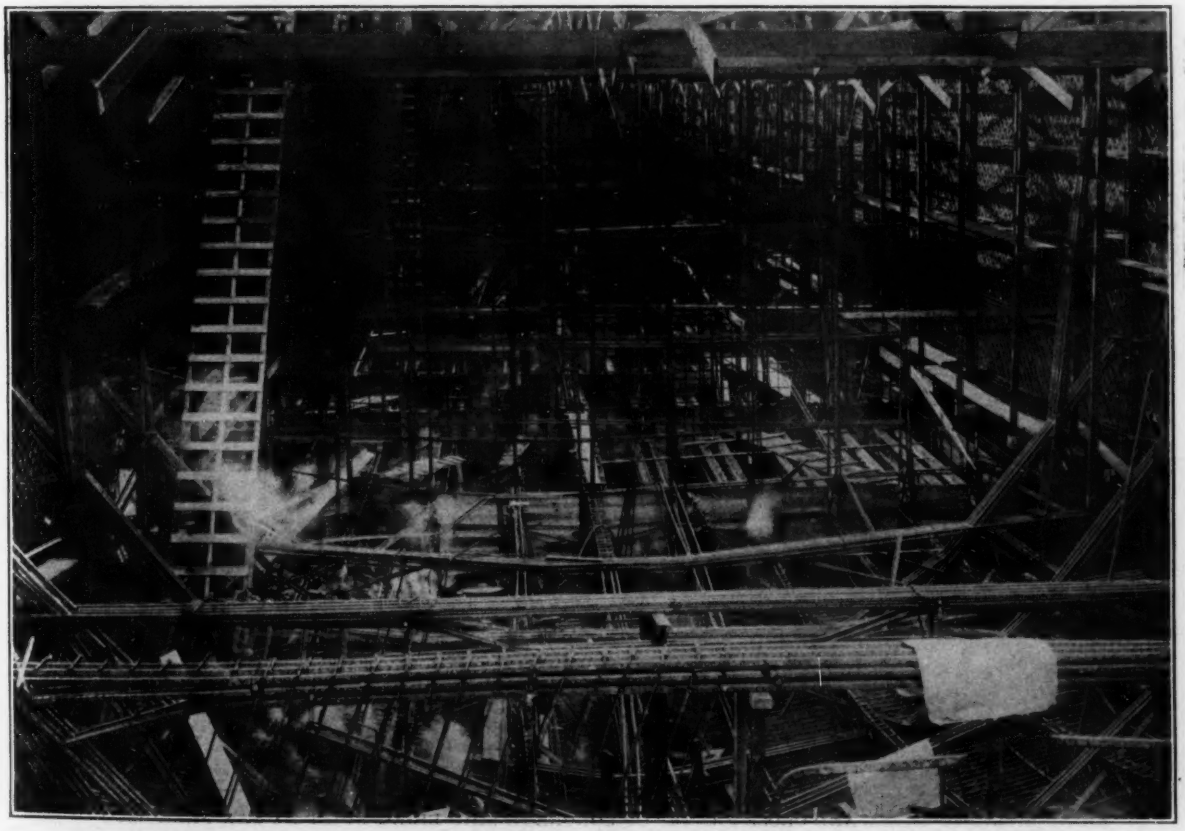
SHIP YARD—FOR THIS FIRST SHIP, NO POWER EQUIPMENT WAS INSTALLED, SAVE FOR THE MIXER AND HOIST—FOR LATER SHIPS ALL POSSIBLE LABOR-SAVING MACHINERY WILL BE EM-



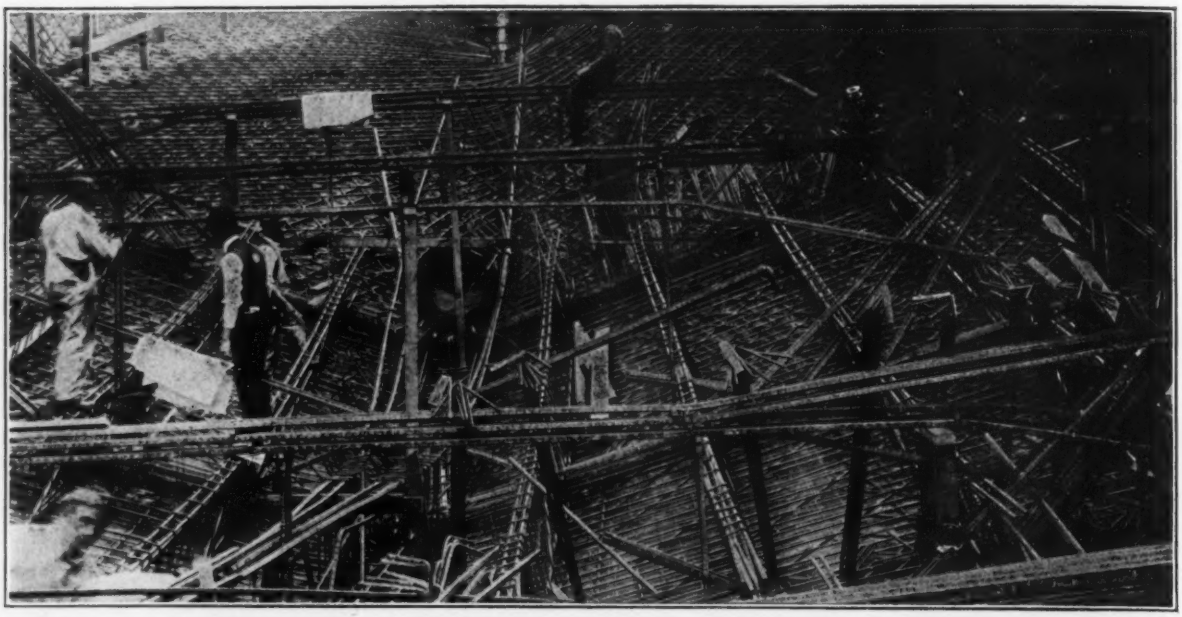
PLOYED—THE CONCRETE IS HOISTED IN THE TOWER AND DISTRIBUTED IN CARTS ON A RUNWAY—THE VIEW AT THE BOTTOM OF THE PAGE SHOWS THE WOODEN FORMS IN PLACE ON THE FLOOR SYSTEM



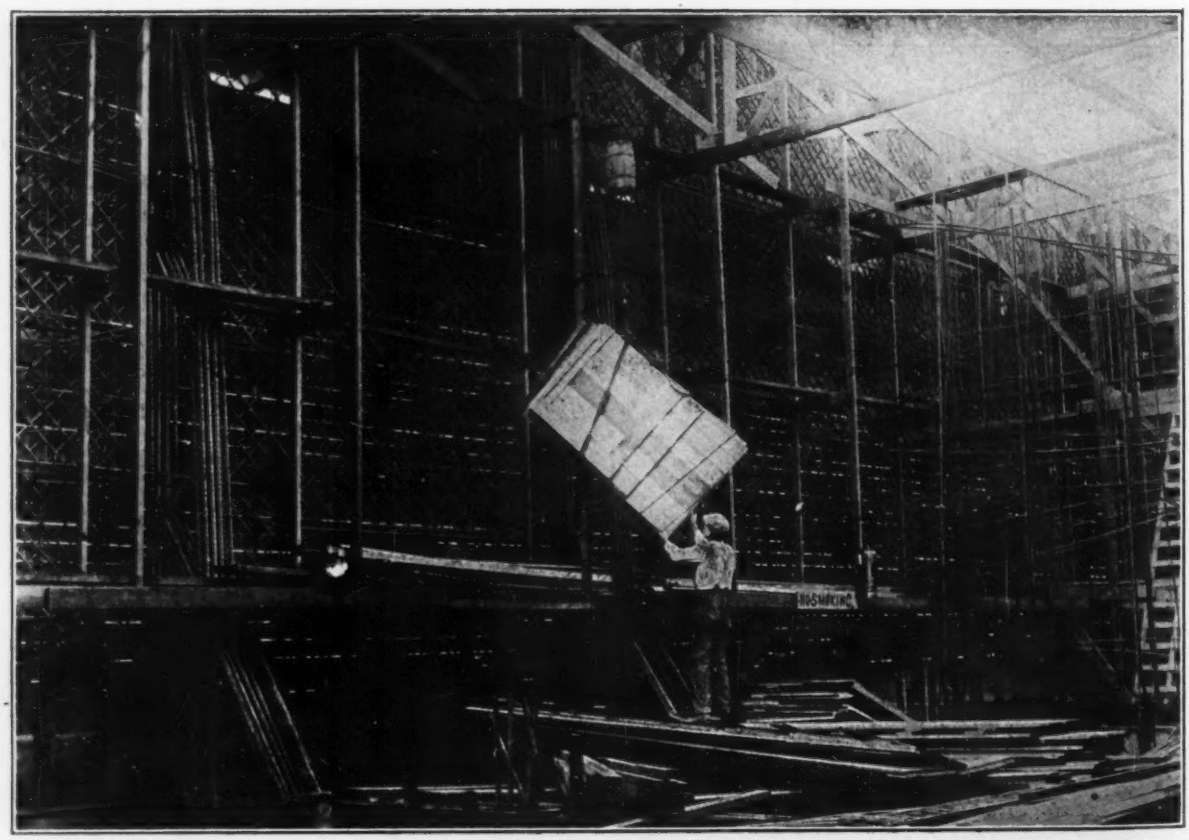
BOTTOM AND SIDE STEEL IN POSITION—PLACING OF STRONG FRAME STEEL WELL ADVANCED



VIEW ON DEC. 31, 1917, LOOKING FORWARD—STEEL FOR BULKHEADS PARTIALLY PLACED



STERN, SHOWING PROPELLER SHAFT SLEEVE—PLACING OF STEEL NOT COMPLETED



REINFORCING OF SHELL AND CROSS FRAMES OF CONCRETE SHIP BEING BUILT BY SAN FRANCISCO SHIPBUILDING COMPANY

Stone-Filled Sheet Asphalt Suffers from Inattention to Detail

Uniformity of Composition Must Be Maintained and Sufficient Surface Energy from Fine Aggregate Provided—A Maximum Thickness of One and a Half Inches on a Close Binder Is Best Practice

By Clifford Richardson
Consulting Engineer, Barber Asphalt Paving Co., New York City

STONE-FILLED asphalt surfaces may be defined as those in which stone, the size of which in various types may be varied from ¼ in. to ½ in., up to 1½ in., or more, coated with asphalt, is a component, uniformly distributed through and imbedded in a mortar of the composition commonly used in the construction of sheet asphalt pavements. Surfaces of this nature have attracted attention during the past six or seven years, becoming known as "Topeka" surfaces from the ruling of the United States District Court of the District of Kansas as to their noninfringement of the Warren patents, and have increased in popularity, as a novelty, in recent years. The character of the mineral aggregate of this surface has been discussed by the writer in two communications to *Engineering Record*, June 29, 1912, p. 718, and Dec. 12, 1914, p. 634. While the statements and conclusions expressed in these articles need no modification at the present time, further evidence offered by service tests of this form of construction makes it possible to draw some additional conclusions in regard to the behavior of such surfaces under the travel which our streets and roads are called upon to carry at present, and to lay down certain principles which should be followed to insure successful results.

In one of the earlier papers referred to it was demonstrated that the essential feature of the decision of the court was that if the coarser particles of the mineral aggregate of such a surface did not exceed 22 per cent. passing a 4-mesh sieve and 10 per cent. passing a 2-mesh sieve, it would not infringe the Warren patent. The grading of the finer portion, while specified, was unessential as far as the interpretation of the decision was concerned. It was shown in this article, however, that to insure a satisfactory surface this part of the aggregate should have a composition corresponding to that of a standard sheet-asphalt mixture. Under these limiting conditions the most satisfactory material would be one of standard grading in which were present 22 per cent. of grit passing a screen of 4 meshes to the inch and 10 per cent. passing a 2-mesh screen, to coat which 3.5 per cent. of their weight of additional bitumen is provided. On this basis such a standard mixture would have the following composition:

	Entire Mixture		Stone Out	Stone
Bitumen	8.2	8.2	10.5	3.3
200 mesh	8.7	8.7	13.0	.....
100 mesh	8.6	.....	13.0	.....
80 mesh	8.7	17.3	13.0	.....
50 mesh	16.0	.....	24.0	.....
40 mesh	7.2	23.2	11.0	.....
30 mesh	5.3	.....	8.0	.....
20 mesh	3.3	.....	5.0	.....
10 mesh	2.0	10.6	3.0	.....
4 mesh	22.0	22.0	.....	66.5
2 mesh	10.0	10.0	.....	30.2
	100.0	100.0	100.5	100.0

These data may be compared with the requirements of the court decision by putting them in another form:

	Court	Actual
Bitumen	7–11	8.2
200 mesh	5–11	8.7
40 mesh	18–30	40.5
10 mesh	25–55	10.6
4 mesh	8–22	22.0
2 mesh	–10	10.0

It appears that an asphalt surface with the proposed standard composition does not depart in any essential feature from the court's decision. It does contain a larger percentage of fine sand, a feature that is not controlled by the patent and which is necessary to furnish a mineral aggregate of sufficient surface development to provide the requisite surface energy for a stable mixture.

As examples of the composition of material used in the construction of asphalt surfaces of the stone-filled type, the following will serve:

NEW JERSEY

	Entire Mixture	Stone Cut
Bitumen	8.1	10.6
200 mesh	8.9	13.1
80 mesh	10.7	15.8
40 mesh	25.3	37.3
10 mesh	15.7	23.2
4 mesh	13.0	.....
2 mesh	17.3	.....
Retained on 2 mesh	1.0	.....
	100.0	100.0

BOROUGH OF BRONX, NEW YORK

	Entire Mixture	Stone Out
Bitumen	8.3	10.4
200 mesh	9.4	13.6
80 mesh	9.5	13.7
40 mesh	23.0	33.2
10 mesh	20.2	29.1
4 mesh	15.4	.....
2 mesh	14.2	.....
	100.0	100.0

While the preceding figures may be considered as representing the composition of standard stone-filled asphalt surfaces which an effort should be made to attain in order to secure success under ordinary conditions, it can be improved where extremely heavy travel is to be carried by increasing the amount and improving the character of the filler used, which involves also an increase in bitumen.

A surface mixture prepared with this end in view had the following composition:

NEW YORK CITY

	Composition		Entire Mixture	Stone Out
Asphalt cement,	110 lbs.	Bitumen	8.9	11.1
Portland cement dust,	110 lbs.	200 mesh	11.9	16.5
Sand,	312 lbs.	80 mesh	14.5	20.1
Stone screenings,	564 lbs.	40 mesh	18.6	25.9
	1,096 lbs.	10 mesh	18.9	26.4
		4 mesh	19.1	.....
		2 mesh	8.1	.....
			100.0	100.0

Very similar to this was a mixture made without the definite addition of portland cement:

ROCHESTER, N. Y.

	Entire Mixture	Stone Out
Bitumen	8.9	11.1
200 mesh	12.3	17.1
80 mesh	10.8	15.0
40 mesh	24.2	33.7
10 mesh	16.3	22.7
4 mesh	21.5	.....
2 mesh	5.4	.....
	99.4	99.6

On the other hand, a departure from the standard in the direction of a poorer grading of the finer portion of the aggregate, as evidenced by the deficiency in sand grains of 80- and 100-mesh size and a lack of filler, will result in a form of construction exhibiting the defects which would be found in an ordinary sheet-asphalt surface possessing the same deficiencies. As examples of stone-filled surfaces of this description the following will serve:

	A MICHIGAN CITY, 1916		AN ILLINOIS CITY, 1916	
	Entire Mixture	Stone Out	Entire Mixture	Stone Out
Bitumen	5.9	7.1	7.2	9.1
200 mesh	8.3	11.7	4.8	7.3
80 mesh	5.3	7.4	5.5	8.4
40 mesh	26.2	37.0	21.0	32.2
10 mesh	26.0	36.8	28.0	43.0
4 mesh	25.3	.....	19.0	.....
2 mesh	3.0	.....	14.5	.....
	100.0	100.0	100.0	100.0

It is plain that such mixtures would result in a very inferior pavement, since it is shown by calculating the composition of the fine portion that one is very deficient in bitumen, one in filler and both in fine sand—and, therefore, too coarse to be stable.

With the diminution in the amount of particles of 4- and 2-mesh size in the mineral aggregate the percentage of bitumen required will, of course, be increased. In the previous examples cited the amount of material of this size has approached the limit permitted by the court decision; but, if in any mixture a smaller amount is present and the mineral aggregate finer as a consequence, the percentage of bitumen required will naturally be larger, as is demonstrated by two mixtures laid in Ontario in 1916:

Bitumen	200	80	40	10	4	2
9.4	12.7	17.7	27.2	17.1	9.1	6.8
9.3	8.6	10.8	32.8	27.7	7.3	3.5

It will be seen that the composition of these mixtures approaches more nearly that of an ordinary sheet-asphalt surface than in the case of those which have been previously cited. Such a mixture cannot be regarded as inferior in a way. It is merely more expensive because of the larger amount of asphalt which is necessarily consumed in its production, owing to the fact that the mineral aggregate is finer.

The preceding statements refer solely to the character of the surface mixture itself without regard to the form of construction of the pavement. The latter consideration is, however, of quite as much importance as the former—the successful behavior of a pavement under heavy travel being as dependent upon the design as upon the materials of construction.

In the production of satisfactory stone-filled mixtures a plant which provides for separating by screening and storing the coarser and finer portions of the aggregate must be available. If the mineral aggregate as it comes heated from the drums is collected in a single bin, segregation takes place. The particles of stone are not uniformly distributed in the bin, and they are still further separated in drawing a charge from the bin to the measuring box. The result is a lack of uniformity in the grading of the mineral aggregate in the mixture as it is sent to the street. This may be illustrated by data showing the composition of a surface mixture produced in this way. In a locality where a rather extended piece of construction was carried out, involving the analysis of sixteen samples, the mixture varied as shown in the following figures:

Bitumen	7.7		9.8	
200 mesh	11.3		11.7	
80 mesh	6.5		8.0	
40 mesh	22.5		39.0	
10 mesh	22.0		18.0	
4 mesh	5.5	30.0	4.0	13.5
2 mesh	24.5		9.5	
	100.0		100.0	

To avoid results such as are illustrated by the previous figures, a plant should be provided in which proper screens separate the hot mineral aggregate into coarser and finer portions which are collected in separate bins. Under such conditions the proportion of coarse to fine aggregate can be better regulated by weighing the two components separately. The grading of a surface mixture turned out at a plant providing such facilities is shown by the following figures:

Bitumen	8.2		8.1		8.9		8.9	
200 mesh	10.3		7.9		9.6		9.6	
80 mesh	9.0		10.0		8.0		7.5	
40 mesh	24.5		23.0		24.5		23.0	
10 mesh	20.0		19.0		20.5		18.0	
4 mesh	15.5	28.0	20.0	32.0	15.5	28.5	15.5	33.0
2 mesh	12.5		12.0		13.0		17.5	
	100.0		100.0		100.0		100.0	

Surfaces of this kind, as is the best practice with ordinary sheet-asphalt surfaces, should be placed on 2 in. of close binder, and should not be more than from 1 to 1½ in. thick. Motor trucks and motor busses are becoming such an important part of the traffic which our streets and roads are called upon to carry at the present time and displacement is caused by the thrust developed by their tires, especially on the application of brakes. Examples of the displacement of the thicker surfaces, especially of those which are placed directly on a concrete foundation with no intermediate course, are so frequent as to demonstrate plainly the defects of such a method of construction.

While the character of the stone-filled surface mixture has been considered at some length in the preceding paragraphs, there are other structural features in connection therewith which cannot be neglected if the use of this type of construction is to succeed. A road surface is no better than the support which it receives—that is to say, than the character of the foundation which supports it—and, furthermore, it is dependent on the stability and dryness of the supporting subsoil which carries this foundation. For this reason, attention to these details of construction are of primary importance.

In conclusion it must be reiterated that a stone-filled or fine asphaltic-concrete asphalt surface requires, in its construction, much greater care and skill and a more elaborate plant than ordinary sheet asphalt; that it should be placed on a course of close binder; and that it should not exceed a thickness of 1½ inches.

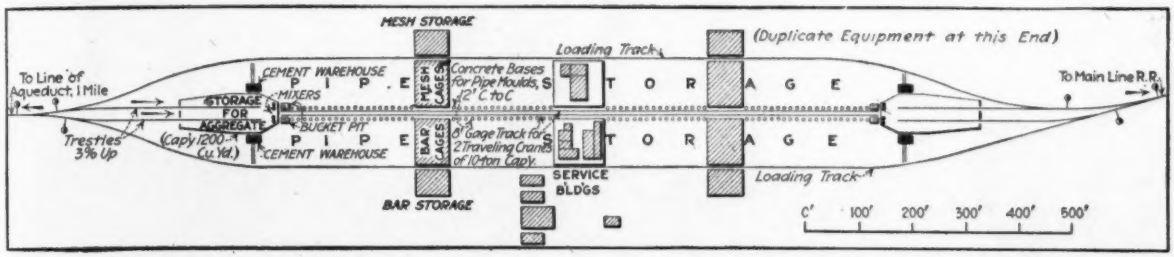
Making and Placing Ten Miles of Concrete Pipe for Winnipeg Aqueduct

Duplicate Yard Layout Permits Rapid Casting of Pipe 5½ Feet in Diameter and 8 Feet Long for Pressure End of Pipe Line—Trenches Dug, Pipe Laid and Trenches Filled with Specially Designed Machines

By K. B. Kumpe

Chief Engineer, Lock Joint Pipe Co., New York City

THE lower 10 miles of the long Winnipeg Aqueduct, that is the section under pressure which connects the flow line with the city mains, is to be of 5½-ft. reinforced-concrete jointed pipe laid in a trench from 14 to 16 ft. deep. All of the pipe, about 6600 in all—for they are cast in 8-ft. lengths—are made in a yard about midway of the line, where a duplicate layout permits rapid pipe manufacture. From this yard the pipes are transported to the trench on a paralleling railway and are put in place by simple but effective machines. The work was started last spring and progressed favorably up to cold weather this winter. This article describes the manufacturing and laying operations.

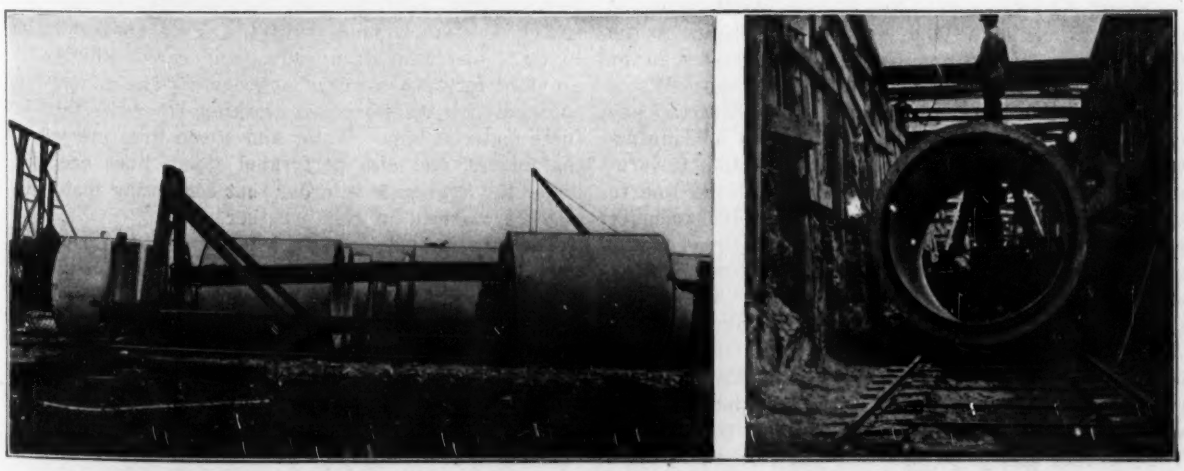


CONCRETE PIPE MAKING PLANT IS IN DUPLICATE AROUND CENTRAL STEEL ASSEMBLY

This line of pipe is circular, 66 in. in internal diameter, with a wall thickness of 8 in. It is reinforced with two concentric steel cages, spaced 2 in. from the inner and outer surfaces, respectively. The inner reinforcing cage is built up of a specially heavy woven section of the American Steel and Wire Co.'s triangular mesh and the outer cages of ½-in. to ⅝-in. square twisted bars, the spacing and size varying with the 45- to 90-ft. head. The mesh, having a constant area, is supplemented where necessary by hard-drawn round rods from No. 4 to $\frac{7}{16}$ in., this reinforcement varying with the amount of backfill and other conditions of external loading, as when passing under highways and railroads.

On account of the depth to which frost penetrates in this locality there is a minimum cover of 6 ft. of earth over the top of the pipe, and the trench is therefore of an average depth of 14 to 16 ft. Heavy blue and yellow clay predominates, and in taking out this excavation a double row of round piling on 11-ft. centers was first driven with the tops flush with the ground. The piles in each row are placed on from 2 to 4 ft. centers and in length averaged about 20 ft. A 40-ton steam shovel carried on movable sectional timber mats resting on the pile tops was used in taking out the cut, the bottom being trimmed by hand.

The foundation for the pipe consists of 7 in. of coarse bank-run gravel spread evenly over the trench bottom. After the pipe is laid, vertical form boards are carried almost to the spring line and a concrete cradle is poured on both sides of the pipe. Coarse gravel backfill is carried to the spring line after the form boards are re-

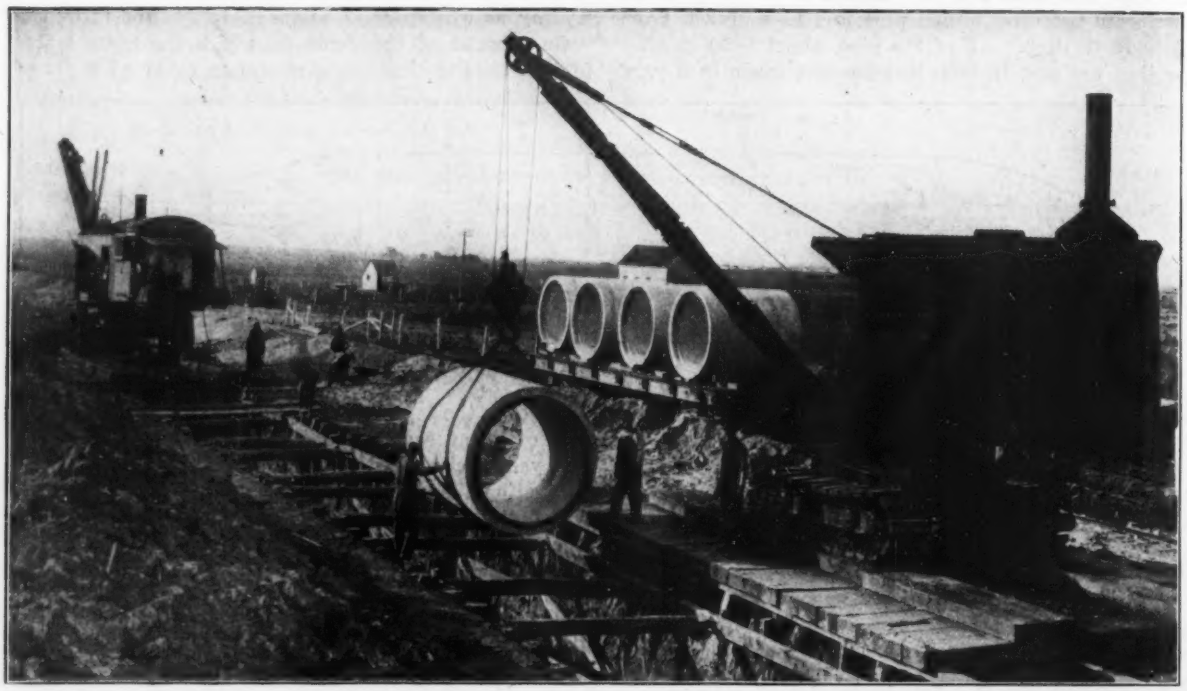


THE PIPE PLACING MACHINE OUTSIDE THE TRENCH AND A PIPE IN THE TRENCH ON THE MACHINE

moved, and a tamped backfill of clay is carried to one foot above the top of the pipe. After the joints are poured the complete backfill is made by drag-line scrapers.

After the tamped backfill is completed and before the joints are poured, a pile puller straddling the trench removes the piles, and they are moved ahead to be redriven. The pile holes are carefully filled with tamped gravel as soon as piles are pulled.

A vitrified drain pipe is carried on one side of the trench for its entire length and finally discharges into the Red River. This tile is between the cradle and the trench side and ground water entering the opposite side of the trench is expected to find its way to this tile by means of the coarse gravel bed.



BOOM DERRICK ON CATERPILLAR TRANSFERS PIPE FROM RAILWAY TO TRENCH DUG BY STEAM SHOVEL TRAVELING ON SECTIONAL MATS

The entire contract was undertaken by the Winnipeg Aqueduct Construction Co., who subcontracted the manufacturing, laying and jointing of this pipe to the Canada Lock Joint Pipe Co., Ltd., whose design of joint had been accepted by the Greater Winnipeg Water District at the time of awarding the contract. The Canada Lock Joint Pipe Co., Ltd., erected a manufacturing plant near Transcona on the Canadian Government Rys., at a point almost midway of the line to be built and distant about one mile. This plant occupies about fifteen acres and is provided with railroad tracks connecting both with the Canadian Government Rys. and the line which parallels the trench. The layout of the yard is shown in the accompanying drawing.

An 8-ft.-gage track, 1075 ft. long, is laid through the center of this yard, to care for two double cantilever cranes which handle all concrete to the pipe molds as well as place all reinforcement after it is built up. These cranes also place and strip the forms and place the pipe on the skidways after it is sufficiently cured to permit handling. A view of one of the cranes is shown in one of the views herewith.

Parallel to this track on each side are 144 concrete slabs to provide a firm foundation for the cast-iron base forms, of which there are also 144. These concrete bases are each provided with five steam jets, one at the center and four on the outside, which in turn are connected through a valve with a steam line fed by two 60-hp. locomotive-type boilers. Canvas covers are provided which enable the pipe to be subjected to a mild moist steam for 48 hours, in order to accelerate the setting.

At each end of the crane track are two pits to receive the 1½-yd. conical concrete buckets, which are each fed by two 10-cu.ft. Little Wonder mixers, gasoline driven. On the cover of this issue is a view of one group of these mixers. Behind each bank of four mixers are two elevated tracks from which the aggregate is dumped to tight platforms from side dump cars. Storage is provided for 3000 cu.yd. of aggregate. The mixers are charged with wheelbarrows working from the face of these material bins. Water and steam lines are led to the mixers, and also perforated steam lines are laid under the aggregate in order that concreting materials may be warmed in cold weather.

The pipe is made in 8 ft. lengths, and 36 forms are provided, giving a daily capacity of 288 lin.ft. of pipe; and, as there are 144 cast-iron bases, it is possible to leave the pipe four days after pouring before tipping and placing on skidways. Each 8-ft. section of pipe weighs approximately 17,000 pounds.

Parallel to the center crane track and 100 ft. distant on each side is a standard-gage track where, by means of a car derrick, the pipe is loaded to cars for transporting to the trench. Each end of the yard is an exact

duplicate of the other, and while the crane and mixer crew is concreting 18 pipe, the other crane is setting up at the other end, after which operations are reversed. Four fabrication yards are provided, two for mesh and two for bar cages. Here, by means of rolls and special mandrels, the cages are built up and rolled to position for cranes to pick up and place on the forms. Shops, storehouses for cement, etc., as well as accommodations for the men are provided.

The aggregate as furnished by the Greater Winnipeg Water District contains approximately 42% sand and 58% gravel of a maximum size of 1½ in. Approximately 1.9 bbl. of cement are used per cubic yard of concrete. The daily output of the plant calls for 136 cu.yd. of concrete, 270 bbl. of cement and 15 tons of steel.

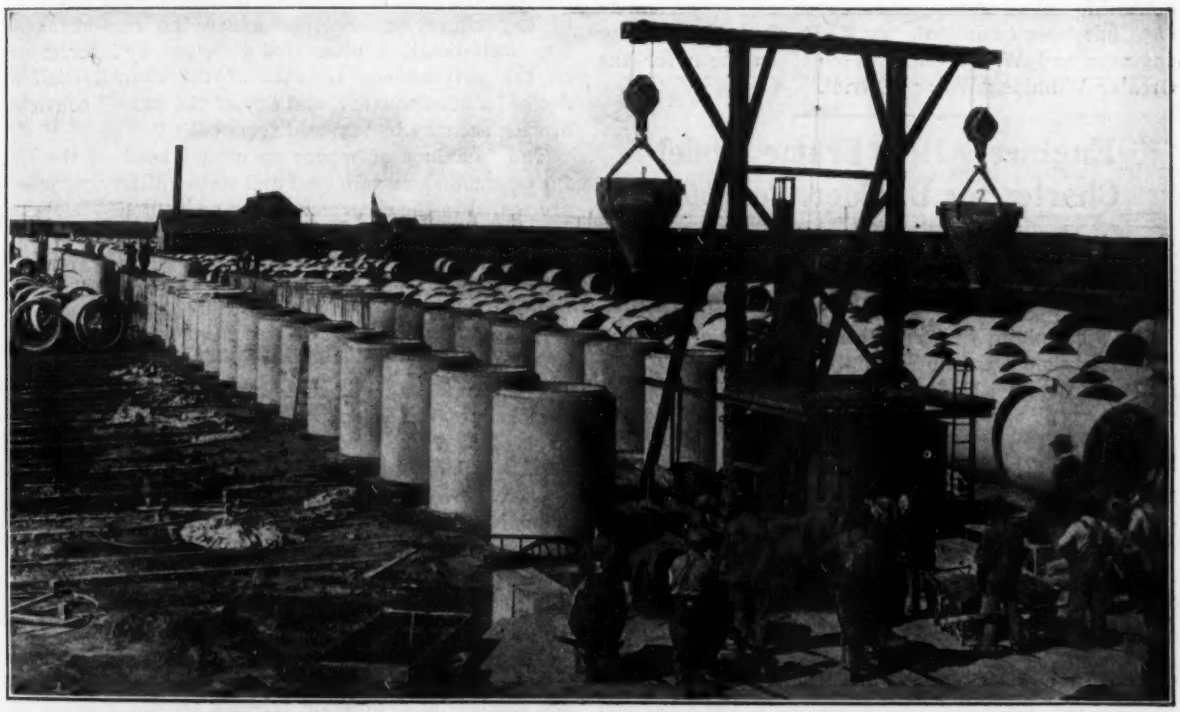
Parallel to the trench for its entire length is a standard-gage railroad, over which pipe, gravel, cement and other material are delivered to the site of the work. A crane of 10 tons capacity having a caterpillar traction is provided to take pipe from the car and place it in the trench. It is shown at work in one of the views. The laying machine consists of a four-wheel truck of standard gage and 15-ft. wheel centers, on which is mounted a 20-ft. beam pivoted over the front set of trucks. The extension of this beam carries a 4-ft. timber given a wide movement by a ball and socket joint, while the other end is connected through an A-frame and suitable sheaves to a three-ton chain hoist. Under the pivot point of beam is a ratchet slide giving cross movement. Concrete counterweights on the rear of the truck permit of the pipe being balanced on the end of the beam and moved ahead to enter its spigot accurately into the bell of the one previously laid. This laying rig runs in the trench on a track of 20-lb. rail in 10-ft. lengths mounted on 3 x 10-in. timbers. Opposite rails are held to gage by bridle rods easily removable to permit pipe to be laid between rails, which are then taken up and moved back. As many as 30 pipe or 240 ft. per ten-hour day have been placed by this method. Two views of the laying machine appear herewith.

After the pipes are joined the space between shoulders is pointed up with a stiff mortar, whose function is to prevent dirt or ground water entering the joint recess before the joint is made and also to retain the grout while pouring the joint.

As previously mentioned, the joint is not poured until the backfill is brought up to one foot above the top of pipe and the piles are pulled, as it is desirable that final settlement or displacement, if any, take place while the individual lengths of pipe are free to move without injury to the joint.

After each length of pipe is correctly placed to line and grade a hole about 4 in. square is broken out of the bell to serve later as a means of introducing the joint grout. This hole is temporarily covered with a piece of roofing paper and held in place by a small amount of mortar.

There is placed in the spigot of the pipe when manufactured an endless copper band 5 in. wide, having a closed bead rolled into it 1½ in. from one edge. This copper water stop is so placed that the bead is just at the end of the spigot, leaving 1½ in. of copper protruding. The outside end of the spigot is painted with a thin asphaltic coat to prevent the grout joint or key from bonding to the pipe itself, although the copper is roughened to insure this key being firmly gripped by the grout, which is also bonded to the bell end of the



CANTILEVER CRANE CARRIES CONCRETE BUCKETS FROM MIXERS IN FOREGROUND TO PIPE BEING CAST

other pipe by means of the protruding mesh, as in the Meriwether lock joint.

After the backfill has been placed for a sufficient time to insure all final settlement having taken place, the joint recess is carefully cleaned out and wetted, and a steel sealing band or form is closely fitted to the inside of the pipe, lapping over the joint recess. The cover over the hole previously broken in the top of the joint is then removed, and the recess filled with a 1:1 mortar. After hardening properly, the forms are removed, and the joint is scraped and roughened to receive properly the secondary joint.

The poured or primary joints are not brought out to the surface of the pipe, but are recessed $\frac{3}{16}$ in. and this recess is later filled and a continuous smooth surface formed by a plaster coat of neat cement, specially ground to pass a 200-mesh screen.

Laying has been carried out on two points, and the equipment above described has been duplicated.

This contract approximates $1,350,000 in cash and is to be completed on Oct. 31, 1918. Work was commenced on the construction of plant and railroads in March of this year, and in spite of a very early close down this fall on account of cold weather, approximately 45% has been completed. J. H. Fuertes is consulting engineer and W. G. Chace is chief engineer for the Greater Winnipeg Water District.

Engineers Help Frame Model Charter for Boulder, Colorado

Commission-Manager Plan Has Good Engineering Provisions—Two Engineers Elected to First Commission

THE complaint that engineers do not take the part they should in public affairs is often and justly made. It does not hold good at Boulder, Colo., in so far as the recent framing of a new city charter and the membership of the first council for commission are concerned. Three engineers were active workers for the new charter and one of these was secretary of the charter commission. This secretary and one of the two other engineer workers for the charter were selected in December as members of the commission of nine which assumed charge of the affairs of the city on Jan. 1. The two engineer-members of the new commission are Prof. H. S. Evans, of the University of Colorado, and Clair V. Mann, the latter having been member and secretary of the charter commission and serving also as secretary of the council-elect before the council took office. The third engineer was Assistant Professor Howard E. Phelps.

Municipal Home-Rule Charter

More than a year ago Mr. Mann, in company with two others, began to agitate for a new charter. They secured the coöperation of the so-called middle and working classes. A charter commission of 21 members was elected at a mass meeting and drafted the charter in accordance with the "home-rule" amendment of the State Constitution of Colorado.

Boulder is a city with an estimated population of 12,000, located at the eastern base of the Rocky Mountains, not far from Denver. Under its new charter the city has powers limited only by the constitution of the state and of the United States.

The charter is of the commission-manager type. Besides providing for the initiative, the referendum and the recall, it requires nomination for members of the council (the only elective officers), and also for election in accordance with the Hare system of preferential voting. The recall relates only to elective officers and does not apply during the first six months of holding office. No utility franchise can be granted except by popular vote, and none for a period of more than twenty years.

Nine-Man Council with No Executive Power

The council or commission consists of nine members, elected for terms of three years. Except that it appoints a city manager, a city attorney, a police magistrate, an auditor, and certain advisory boards, the powers of the council are legislative only, it being compelled to deal with all administrative matters solely and directly through the city manager. The members of the council are expressly forbidden to "either dictate the appointment or direct or interfere with the work of any officer or employee under the city manager. Any such dictation, attempted direction, or interference on the part of any member of the council shall be deemed a misdemeanor, and any of the council convicted of such act may be removed from office."

The functions of mayor as official head of the city for ceremonial, certain civil and state military purposes, are vested in the chairman of the council, who is elected by that body to serve for two years. The mayor may be removed from his office as mayor but not from the office of councilman, by a two-thirds vote of all the members of the council.

City Manager Selected On Merit

The city manager is chosen by the council "solely on the basis of his executive and administrative qualifications. The choice need not be limited to the inhabitants of the city or state." The appointment is for an indefinite period, but the manager is removable by the council at pleasure. If the council proposes to remove the manager after six months' service, he may demand written charges and a public hearing. The administrative work of the city, in each case under the supervision and control of the city manager, is intrusted to six departments. Four of these; namely, public service, finance and records, public health, and public welfare, are headed by a director "chosen on the basis of his general executive and administrative experience and ability, and of his special education, training and experience in the class of work which he is to administer; provided that the director of public service shall be an engineer with training and experience in municipal engineering; and the director of public health shall be a sanitary engineer, or a member of the medical profession, who has had special training in public-health work."

Service Director Ex-Officio City Engineer

The director of public service is ex-officio city engineer. He has charge of the construction, improvement, repair and maintenance of the various public works

and utilities of the city, including the construction and maintenance of parks and playgrounds, but not their management.

The city manager, until otherwise provided by charter amendment, is ex-officio director of public safety. The department of planning and parks is in charge of a planning and parks commission, consisting of the city manager, the director of public service and public welfare, and six especially qualified citizens, the latter serving without pay and being appointed by the council and removable by the council for cause.

The city manager frames the annual budgets which must show in parallel columns the actual receipts from taxes and other sources for the current and the last preceding year and the estimated revenues of the city for the ensuing fiscal year.

Bonded indebtedness must not be incurred in excess of 3% of the assessed valuation of the taxable property of the city, but this limit shall not apply to bonds issued for the construction of water-works and other public utilities that produce a revenue. Water-works revenues shall be used exclusively for water-works purposes. No free water service will be given other than to the city itself.

For any and all municipally-owned utilities, the city must keep separate accounts which shall show complete financial results in all respects, including the value of water or other services furnished for the use of the city.

A civil service commission may be created by the council in the future if it sees fit. Except for the officers already named as appointed by the council, all appointments are made by the city manager, including various subordinates.

Before taking office, the council elect advertised in the technical press for applications for the position of city manager. On Dec. 30, Mr. Mann wrote as follows: "The council elect of the city of Boulder is finding that there are many prospective city managers in the country who read *Engineering News-Record*. We have had a flood of applications, principally from engineers. Many of these are from prominent and experienced men."

How Soon After Concreting Should a Pavement Be Rolled?

That different intervals should be allowed between the several finishing processes on a concrete road in summer and in fall is conceded, but what are they? On an 18-ft. pavement on Lincoln Avenue road, Cook County, Illinois, the contractor, the Chicago Heights Coal Co., got the best results by rolling one hour after the concrete was deposited and screeded. He increased the time in the fall to two hours. The same intervals applied when a 10-in. canvas belt was used instead. In summer there was an interval of from one-half to one hour between the rolling or belt dressing and the final belt finish. In the fall it was necessary for the best results to increase this interval to 1½ to two hours. The 9-in. 70-lb. sheet-iron roller was 6 ft. long and was operated by two ropes instead of by a long handle. On this work 30 to 35 men averaged 413 lin.ft. of 18-ft. pavement per day, the best day's work being 538 lin.ft.

Williard Hildeman is superintendent for the contractor and A. F. Keehner is resident engineer.

Sump in Combined Sewer Diverts Flow to Sanitary Sewer

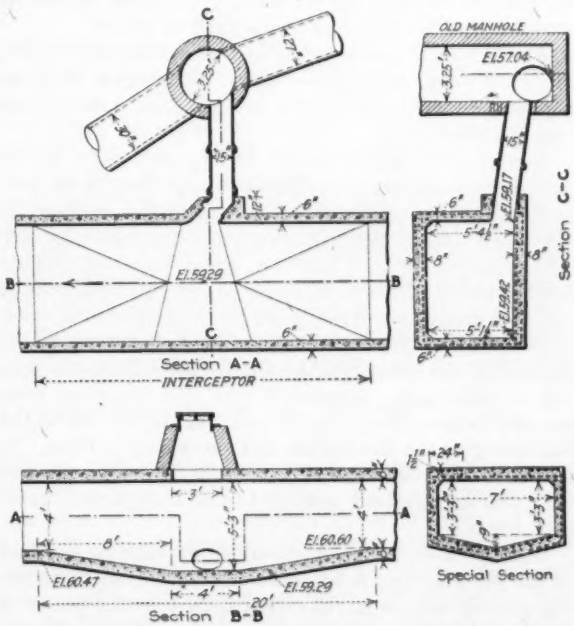
In Successful Use at Kansas City, Mo.—Design Shown Could Be Adapted to General Use

By H. F. Johnson

Assistant Engineer, Union Pacific Railroad Co., Hastings, Neb.

THE writer has never found a design for a sewer intercepter which he considered satisfactory. The intercepter shown herewith was designed under his direction while he was engineer in charge of the sewer division at Kansas City, Mo. Although this design has some disadvantages, it is believed that it eliminates some of the faults of the ordinary hopper bottom, overflow and leaping weir intercepters.

The intercepter shown is primarily a sump in the invert of a combined sewer, with a sanitary outlet having its flow directed away from the storm flow. The



SUMP INTERCEPTER DIVERTS SEWAGE FROM COMBINED TO SANITARY SEWER

sump is of sufficient capacity to feed to the sanitary outlet the estimated maximum volume of sanitary sewage from the district served, during the life of the sewer.

This form of intercepter does not collect and wash into the sanitary sewer as great a quantity of detritus as do some of the ordinary forms of intercepters. The small amount of detritus which accumulates is washed through the storm-water outfall during the next storm.

The intercepter illustrated has been in use at Kansas City for nearly two years and has given entire satisfaction. It was built to conform to and connect with a special section made necessary by the small amount of head room available in this particular case. However, the design could easily be modified to fit almost any sewer section.

Place and Duty of the Engineer in the Social Structure

Should Form Local Associations Devoted to the Larger Service of the Community—Union of All the Founder Societies the Greatest Step in the Advancement of the Profession

[Due to the abandonment of the last convention of the American Society of Civil Engineers, which was to have been held in June, 1917, the Board of Direction requested George H. Pegram, the retiring president, to deliver his annual address at the annual meeting which is being held this week at the United Engineering Societies' Building, New York City. Through the courtesy of Mr. Pegram, extracts from his remarks are given here.]

THE great world-war is imposing supreme tests on the virtues, faults, and philosophies of all peoples: their industrial, economic, financial and political organizations will undergo great changes. In this reformation there is the greatest hope for the engineer, and as he has always been the keystone in the arch of war he may become the keystone in the arch of peace.

Practically all of the world's great military commanders have been engineers—Cæsar, Bonaparte, Wellington, in the past, and in the present war, Joffre, Haig and Hindenburg.

In our own country many of the men who gained prominence during the Revolutionary War were surveyors, that being the general work of the engineer of that day. Ira Allen of Vermont, one of the ablest diplomats and financiers of his time, was a surveyor, serving for a number of years as surveyor-general of his state. He was one of the first to propose building the canal to connect Lake Champlain with the St. Lawrence River. General Stark, the hero of the Battle of Bennington, was a millwright. General Wayne, like his great commander General Washington, was a surveyor, and at the beginning of the Revolution was surveying in Ohio. In our Civil War the engineer was similarly prominent, and this was emphasized among the officers drawn from civil life.

War involves many engineering operations—in fact at the present time it has become so much an engineering science that we might expect such a distinction were it not that higher qualities than mere professional technique are required in generalship which demands the organization and control of masses of men and administrative ability of the very highest order. The engineer has so generally responded to these higher requirements in time of war when the best services must be had, that we may reasonably ask why greater use is not made of his administrative qualities in times of peace.

Preparation for War

Nearly three years ago our engineers began the agitation of preparedness for war. In March, 1915, a committee was appointed whose work resulted in law authorizing the Engineer Officers' Reserve Corps, by which civilian engineers are made part of the army. Groups of engineers in different parts of the country provided military lectures, preparedness parades and other movements in anticipation of the possibility of our being drawn into the war.

In appreciation of the services which might be rendered by the enginers, the Administration at Washington wisely called them into council, resulting in the formation of the Naval Advisory Board, the Council of National Defense, and the Bureau of Scientific Research, in all of which our most skilled and prominent engineers have from the first been, and are now, unselfishly devoting their services to the needs of the country without remunerative return even for their expenditures. And our society, as you know, offered its services to the President immediately upon the declaration of war and has responded to every call.

Eleven Per Cent. of Membership in Army

In spite of the fact that but 11.5 per cent. of our membership is within the draft age limit, 11 per cent. is now in the army and the number is rapidly increasing. Men of mature age without previous military training, but whose prominence in the profession would entitle them to entire immunity, have gone to the front.

The Engineering Mission from the United States to Russia has performed a task which, despite the political revolution, must bear great future fruit—for Russia, next to China, has the greatest undeveloped resources of any country in the world. And hereafter the field of the engineer, like the present field of the soldier, will be less limited by national boundaries.

The engineer by his education and technical training and especially because he enjoys the confidence of all classes of the community, is well prepared to enter actively into public discussions and public service, and should do so. To that end the engineer should form local associations devoted, beyond the consideration of the technical and scientific aspects of engineering, to the larger service of the community as a coöperative part in public affairs.

Determination of Engineers to Coöperate

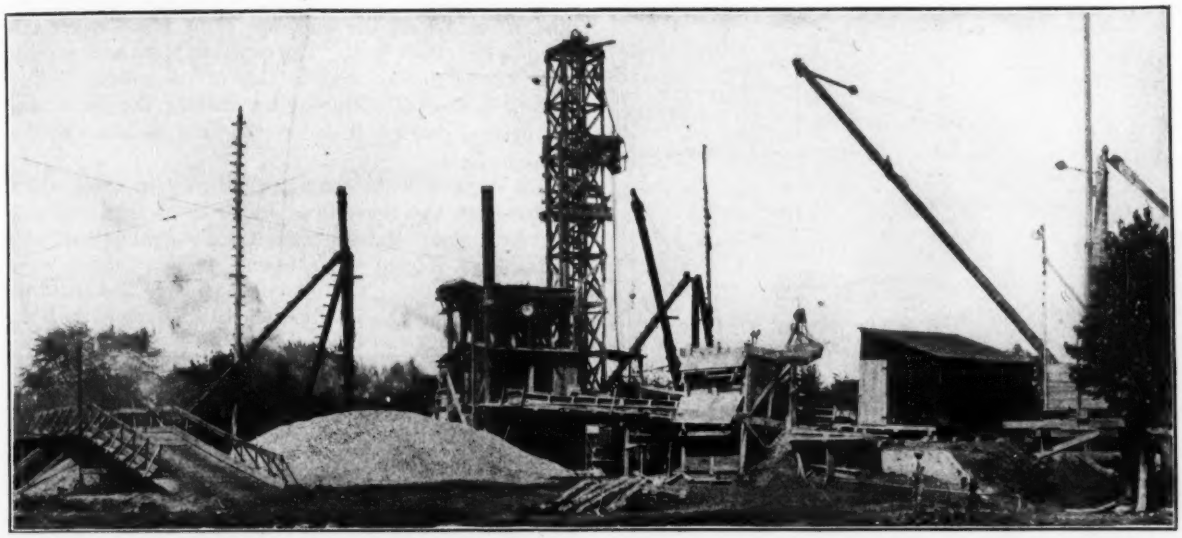
Last year our society joined with the other founder societies in the formation of the Engineering Council, designed to represent the present growing membership of thirty thousand engineers in the consideration of public matters. While in itself the greatest step that has been taken looking to the advancement of the profession, the movement is especially inspiring as indicating the determination of engineers to coöperate. At the magnificent celebration at which we were welcomed to our new home by the other founder societies this sentiment was expressed by all the speakers.

But other steps are necessary. It would seem that an organization should be formed devoted to the material interests of the younger men, draftsmen, instrument men, inspectors, etc., with such association with the older engineers that their development and progress may be encouraged; in brief, an alliance of all engineering interests which would be in harmony with similar organizations in nearly all lines of endeavor.

Land Big Drop Shaft on Seal and Curb Wall

Fifteen-Pocket Concrete Caisson Sunk 100 Feet—Because of Thick Boulder Stratum Near Top Shaft Proved Hard To Guide

A CONCRETE caisson constructed on Government property under the direction of the Bureau of Yards and Docks for a special purpose which required landing it exactly to grade and in a vertical position, has just been completed after some remarkable work in guiding and handling. Though air was not used, pumps keeping the water down so that material could be dug from beneath the cutting edges by hand, the 45 x 78-ft. reinforced-concrete box was too large to permit the use of guide-frames, pushers and other building-caisson methods. When, therefore, it neared the bottom a few inches out of plumb, a heavy concrete seal was placed and a concrete curb wall built to exact elevation before the last drop was taken. In the meantime, jets supplied with several hundred pounds' pressure by borrowed fire engines were used to churn up the soil on the high side, from which weight had previously been removed by taking off the overburden with a steam shovel.



CONCRETE SPOUTING PLANT AND TWO DREDGING DERRICKS, ONE AT EACH END, HANDLED CAISSON

On account of the peculiar use to be made of it, the caisson differs from bridge-pier or power-plant construction in design, and from mine shafts in size. Its outer walls, shod with a fabricated steel cutting edge, are of 5-ft. thick reinforced concrete, 45 x 78 ft. in overall dimensions. The space inside these walls is divided into three pockets across the width and five pockets along the length of the caisson, making fifteen in all. Between these pockets are 2-ft. thick reinforced-concrete dividing walls, extending from a point 2 ft. above the cutting edge to the middle of the caisson, 50 ft. from the top. Above the concrete walls the division into pockets will be continued with steel walls which were not installed until the caisson had been sunk. On this account, timber bracing above the line of the dividing walls was put in. To facilitate dredging, the inside of each pocket was lined with vertical 4 x 12-in. plank. The caisson will be part of a Government factory building inside which it is located. The floor level of this building was 12 ft. below the original ground surface at the point where the caisson was located, and as the latter was of course begun first, it was possible to excavate quite a deep open pit before erecting the cutting edge.

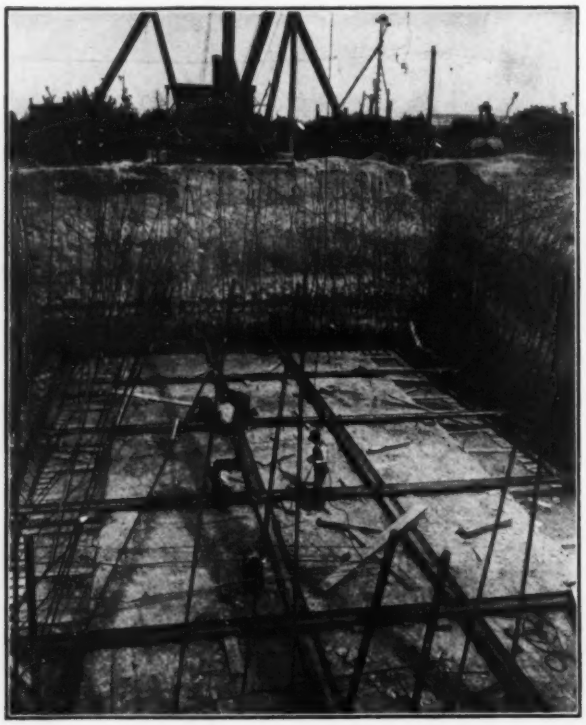
This pit extended within 8 ft. of ground water level, which, taking the finished floor at 100 and the cutting edge in final position at 0, would be elevation 78. The pit was in clay, and on its floor the steel cutting edge was blocked up and erected in the usual way, and concrete placed to a height of 14 ft. for the first lift. After this, concrete was placed in 6-ft. lifts, one being placed, bringing the structure to a height of 20 ft., before sinking was begun. This was the greatest height above ground reached during construction, though on another occasion a little more than two lifts were above the ground at one time.

The sinking was carried on by a derrick with a 60-ft. boom set at each end of the box. These derricks, operated with three-drum hoists, handled 1½-yd. clamshell buckets. The excavated material was dumped into a hopper and taken away by teams.

Near water level the sinking encountered sand and gravel for 11 ft., below which for 19 ft. the gravel seam contained boulders up to 1 yd. in size. Much of this material ran in, and caused some caving around the caisson. Until a 20-ft. seam of shale below it had been entered, shutting off the water, the caisson could not be pumped, and was dredged down in the wet. Below the shale the caisson was carried 39 ft. through layers of sand, peat and clay. All this material had to be picked and shoveled from beneath the cutting edge and cross-

walls to the centers of the pockets where it could be reached by the grab-buckets. During this time the water was handled without difficulty by several large Pulsometer and Nye steam pumps, of which nine were on the job. Two lifts were required, the lower pumps discharging into a tank half way up the caisson, from which point the second set of pumps raised the water to the surface.

The caisson, when virtually complete, weighed 10,000 tons. In addition to the weight of concrete, some of the



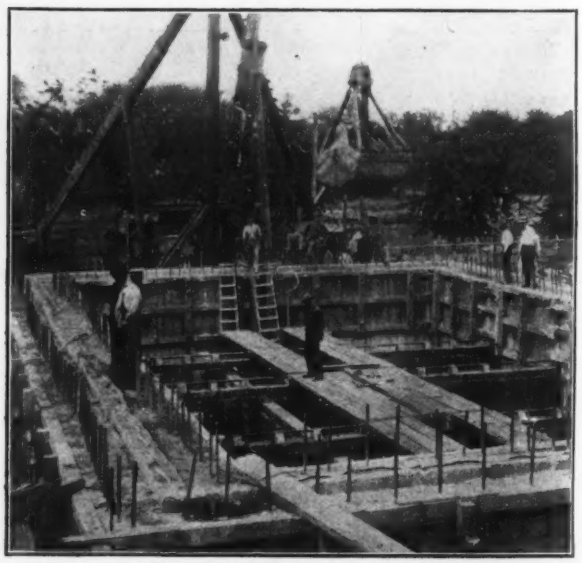
STEEL-SHOD CONCRETE CUTTING EDGE WAS HEAVILY REINFORCED

pockets were floored over and filled with dirt for additional weight during sinking. A maximum of about 1000 tons of earth could be added in this way. Often, however, this was not sufficient to make the caisson drop as desired. To jar the surrounding earth, in order to lighten the skin friction and give the caisson a chance to start, small charges of dynamite were fired in the ground around the caisson. The effects of this shooting were immediate in virtually every case, the box moving from 6 in. to 8 ft. at a time. It was finally found best to put down about six shots on each long side, loading each hole with 1½ lb. of dynamite and firing all together with a battery. The shots were generally placed about half-way between the cutting edge and the surface, and about 3 ft. from the outside skin.

During the descent the caisson, as was only to be expected with a shaft of such size, got slightly out of plumb. Most of the movement was at right angles to the long dimension and away from the side on which the concrete plant was located. This left one long side of the cutting edge higher than the other. The entire movement amounted to less than five inches out of the perpendicular in the height of the caisson. By this time the caisson had passed through the sand and boulders and was well entered in the stiff clay. Efforts were made, by placing almost solid blocking under the low side of the cutting edge, to right the caisson in taking a drop. This had little effect on account of the great side area of the caisson and the consequent amount of dirt to be displaced. Next, the blocking was tried in connection with extensive jetting along the high side, in an effort to displace some of the sand and gravel and reduce the shale to a mushy consistency. A fire engine was borrowed for the purpose and pressure of about 250 lb. was put on the jets. Even this, though the jets penetrated the shale, did not have much effect, the caisson still being 4½ in. out of plumb after taking a drop which brought it to within 3 ft. of grade.

It was then decided that there would be a better chance of success if the earth on the high side of the caisson, on which the concrete plant stood, were cut down to final floor level. The concrete plant was accordingly moved to the opposite side of the caisson before putting in the seal. During the moving the excavation was carried down 5 ft. below the final elevation of the cutting edge.

The excavation for the main building was well along by this date, and it required only a short time to throw one of the steam shovels engaged on it against the bank on the high side of the caisson. In less than a week this was removed. The excavation inside the shaft itself was finished and a concrete bench from 4 to 6 ft.



TIMBER BRACING REPLACED AFTER COMPLETION WITH STEEL

wide was carried up all around under the cutting edge, its top being at the exact final elevation required.

The final drop was taken after the ground on the high side of the caisson had been jetted under about 300 lb. pressure by a fire engine. Although the drop did not right the caisson, possibly because it was surrounded by boulders too heavy to be affected by any jetting, the concrete curb, which crushed slightly on the low side, stopped the caisson at exact elevation, and the jetting and blocking prevented it from going any further out of plumb.

When completed, the concrete seal will extend to a height of 10 ft. above cutting edge, or 8 ft. above the lower edge of the original dividing walls. Including the seal, 6000 yd. of concrete are required for the entire structure. The sand and gravel for this concrete were delivered on the ground back of the concrete plant by motor trucks from a pier a few hundred feet from the site, while cement was hauled about 1000 ft. from a railroad siding. The bins over the concrete mixer were kept filled by a clamshell derrick. The concrete was placed by a spouting system which covered the entire caisson. The caisson was very heavily reinforced, 350 tons of bars being placed in the outside and dividing walls. The bars were mostly straight and were handled and set in the forms by hand.

The work was done for the Navy Department by The Foundation Co., under the direction of the public works officer of the reservation concerned, and under the general supervision of the Bureau of Yards and Docks, of which Rear Admiral Frederick R. Harris was chief at the time.

Land Reclamation Offers a Wide Engineering Field

Initiative and Coöperative Action Help Technical Skill in Increasing Food Resources

POSSIBILITIES for the engineer in developing the productive use of the arid and swampy areas of the public lands form the theme of a recent paper on "Engineering Work in Food Supply," by Prof. F. H. Newell, head of the civil engineering department of the University of Illinois. This was presented at the annual meeting of the American Society of Agricultural Engineers, held in Chicago Dec. 27 to 29. These notes are taken from his paper.

Enormous tracts of vacant public lands remain in the Western states, but these cannot be utilized at once, and cannot be disposed of in the same manner as the lands given away a generation ago. The best lands and the choice spots have passed into private or corporate control, and it is the less favorable lands that remain. The agricultural engineer has here his great duty and opportunity in studying the conditions of soil, climate, transportation and market facilities, and then devising ways in which the land may be put into the hands of men who can till it successfully.

Utilize Both Deserts and Swamps

Great schemes for reclamation of desert lands by water stored in mountain reservoirs may be evolved by the engineer, but he finds that each scheme has some apparently unsurmountable obstacle. He learns that comparatively few of the settlers make a success, due partly to lack of skill or experience, but more largely to need of adequate capital. He learns also that after the lands have been watered it has required many years to ascertain the crop and market conditions. Everywhere there is shown to be need of caution in future undertakings.

Beyond these lessons of caution, however, the engineer sees that great progress has been made, and that arid lands formerly regarded as worthless are now producing crops which form an important addition to the food supply in time of stress. He must draw the conclusion that in spite of past errors or present difficulties there is greater possibility in the use of public lands than has yet been realized.

What of the vast swamp areas? The chief difficulty here is that under the mistaken assumptions of a former generation the swamp lands were donated by Congress to the states, with the understanding that the latter would provide for their reclamation. Instead, these lands were practically given away by the states, partly to large corporations. While portions have been reclaimed by drainage, most of them still lie unproductive and are held out of use by speculative interests.

In the flooded areas the agricultural engineer can perhaps most quickly show what can be done by employing his skill and experience. If these lands still remained in the hands of the National Government their development following the precedents established by the Reclamation Act might be relatively simple. They could be drained and disposed of in small tracts to actual settlers. But with the incubus of speculative ownership these lands are apparently doomed to lie idle.

Capitalize Present Investment

In securing an additional supply of food and opportunities for homes for the people the problem rests not so much upon the technical skill of the engineer as upon his recognition of the obstacles of human origin, and his initiative or participation in movements for releasing these vast tracts of overflowed lands and desert areas from present conditions unfavorable to their development and utilization, and for transferring the control to the Government, public corporations, or district organizations which will permit the great work to proceed.

The United States has now over $100,000,000 invested in productive irrigation works. The security if properly treated is unquestionable. Money could be borrowed at a small rate of interest on this investment and made available for expenditure elsewhere in similar reclamation works, by irrigation and drainage, with the creation in turn of property values which again would form the basis for obtaining further funds. There is money still left in the world awaiting investment in such permanently productive projects.

Probabilitity of success has been demonstrated, and there is little that is novel in the undertaking. Private enterprise has spent millions of dollars in demonstration. The United States also, acting through the Reclamation Service, has proved that it is possible for the Government to build and to operate great reclamation works and to conduct the business affairs of settlement of the country. It is none too soon to initiate other and larger enterprises for irrigation and drainage, the successful execution of which means more food, more homes and the more permanent free institutions.

Twelve Hundred Steam Gaging Stations

Steam gaging stations to the number of 1197 were being maintained on June 30, 1917, by the U. S. Geological Survey, according to the annual report of Secretary of the Interior Lane. The stations are located in 41 states, Alaska and Hawaii.

New Ocean Freight Terminal Started on Staten Island

Initial Units for Large Development in New York Harbor Comprise Timber Pier and Concrete Warehouse with Special Freight-Handling Equipmen

A NEW ocean terminal with piers alongside of deep water and immediately adjacent to warehouses connected with various trunk lines, is now under construction on the east shore of Staten Island, in New York Harbor by the Staten Island Development Corporation. The new development is called the Pouch Terminal, Inc., and is under the same management as the American Dock Terminal at Tompkinsville, Staten Island. The geographical location of Staten Island and the particular location of this property, places it in an advantageous position, especially valuable for the business of a dock and warehouse terminal. It is near the entrance to the harbor, thus avoiding loss of time in docking vessels; it is directly on a 40-ft. channel, which permits docking of steamers of the largest size at all tides; it is within the free lighterage limits, which places it commercially on the same basis as other waterfront property in the harbor and it has the advantage of direct rail connection, independent of float or lighterage service. There is double transportation facilities for passengers, being connected both by trolley and steam road to the New York Ferry.

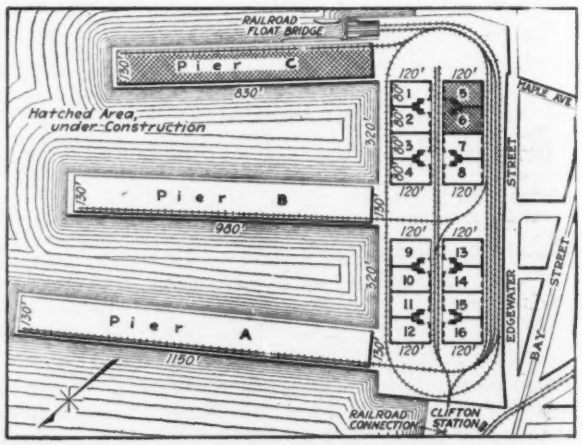
The property now being developed, covers an area of about thirty-three acres and has a waterfrontage of about 1200 ft. and is located just north of the Quarantine Station. The surrounding neighborhood is made up of an old established community and only a short distance from the Italian settlement at Rosebank, which furnishes an excellent labor market for industrial or commercial purposes.

The entire development, as shown in the general plan layout, will comprise three large piers ranging in length from 830 to 1150 ft., extending out from the warehouse area which will contain four groups of warehouses, each one of which contains two twin units separated by fire walls. The twin units are of identical design built around a central railroad, with rail approaches on both long sides. Now under construction is Pier C, the most southerly of the three piers and one unit warehouse comprising the twin structures noted on the plan as Nos. 5 and 6. In addition, the main bulkhead extending along the whole front of the property has been built.

The water line at the site when taken over extended up into the future warehouse area. The bulkheads are typical New York timber construction extending 1200 ft. along the front of the property and the shore-end area filled up to grade with an ash fill. The pier, as shown on the drawing, is 830 ft. long and 130 ft. wide. It has throughout a timber substructure composed of transverse wooden pile bents carrying transverse timber stringers and a 10-in. reinforced-concrete slab. Details of the construction are shown on the accompanying drawings. They are of the simplest possible form consistent with strength. It will be noted that special reinforcing of the timber work occurs under the railroad track which runs out on the pier, and that there is thorough transverse cross-bracing. Longitudinal bracing is provided for by the railroad stringers and by the side caps and rangers over a central 12 x 12-in. brace running the length of the pier. The outer corner of the piers are protected by clusters of piles tied together with chains. The concrete slab is reinforced as shown in one of the drawings, and carries in addition to the 10-in. thickness, a 2½-in. surface of asphalt. According to the specifications, the concrete slab is to be laid in alternate strips corresponding in width to the distance between center lines of the pile rows.

In view of the attention given to the fire protection of terminal piers, it is interesting to observe that the pier shed is of timber semi-mill construction. It has been so designed, however, and so provided with sprinklers and fire-protection mains as to make possible an insurance rate as low as that on similarly protected steel piers.

Drawings show the details of the shed. It comprises triangular wooden trusses, resting on H-beam steel columns spaced 20 ft. c. to c. The roof has on each slope two rows of skylights, each 6 ft. 9 in. by 8 ft. in area,



ONE PIER AND A TWIN WAREHOUSE OF POUCH TERMINAL ARE NOW BUILDING

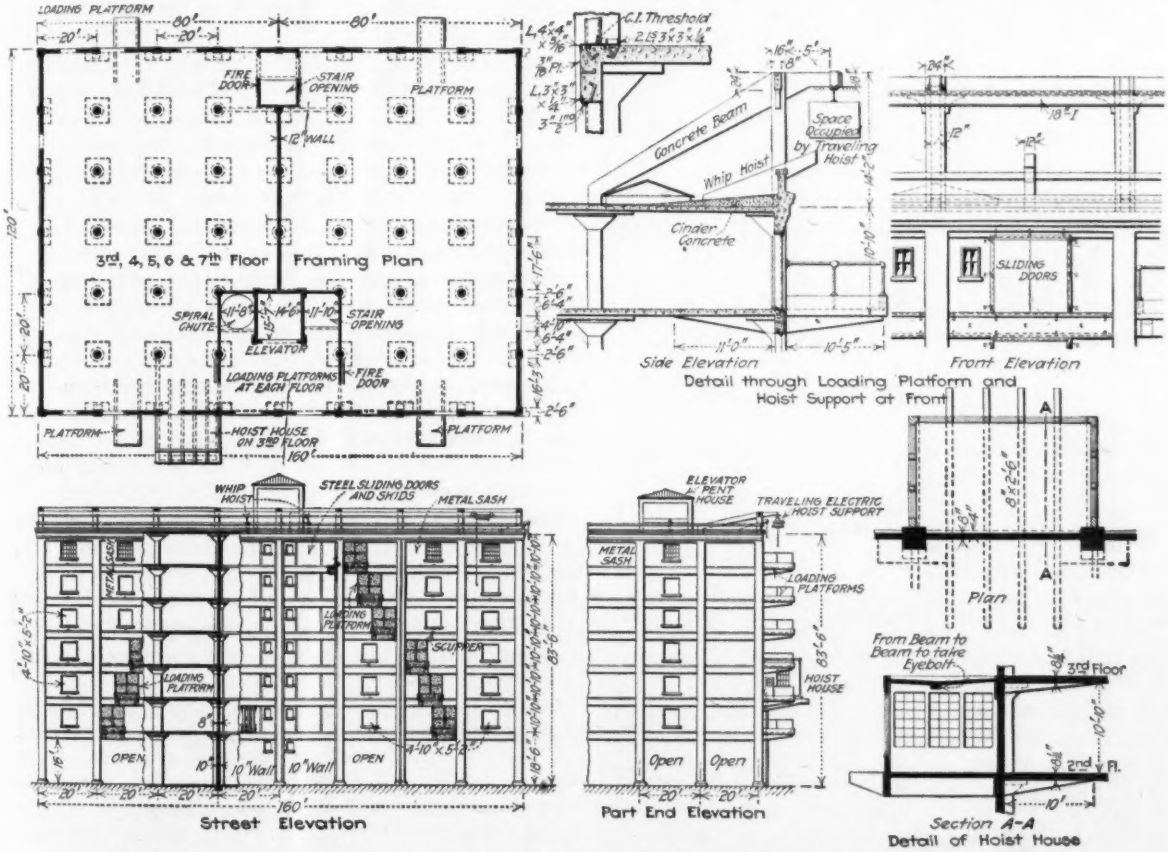
the rest of the roof surface being of a composition slate material laid on roofing boards. The sides of the shed are wooden iron-clad doors, running on track along the entire length of the shed, one door in every other 20-ft. panel. The sheathing where there are no doors, is of corrugated galvanized iron on yellow pine studding. There being only one line of center columns, the shed area is especially spacious for handling large cargoes.

A special roof drainage device is provided in the way of flashing near the roof eaves. This centers at each column and rises up the roof on a straight line to meet between the columns at 2 ft. above the eaves. Water coming down the roof is intercepted by the flashing and is led to the columns, where it runs down the channel riveted to the outside of the H-beam post, thereby elim-

inating the risk of damage from inside leaders of old type.

On both sides of shed, between stringers and sheathing, there is an open space or driveway of 9 ft. which serves a double purpose, of allowing large packages of freight to be handled, to and from steamers, without injury to shed, and for additional access to the pier for small electric trucks and tractors without entering the pier shed, thus reducing congestion of inside driveways. The railroad track is located inside of shed to permit of loading cars in stormy weather. A spacious office for steamship clerks has been provided at the shore end of pier, at an elevation of sufficient height to permit of a general view of entire length of pier shed, thus giving men in charge full supervision over every detail of adjoining street and railroad tracks. The railroad tracks do not enter this floor, but run immediately alongside on both the bulkhead and inside front of the building. This open space, which is paved with concrete, permits the quick temporary storage of material brought in by trains and trucks, for which there is not sufficient time or in which the congestion is too great to permit immediate elevating to the other floors of the building. It serves likewise for storage of material brought down from the warehouse to be taken away.

The floors themselves have several entrances. The principal of these entrances are the doors opening from each floor to cantilever platforms overhanging both fronts of the building. These platforms, as will be noted, are staggered up the face of the building and are



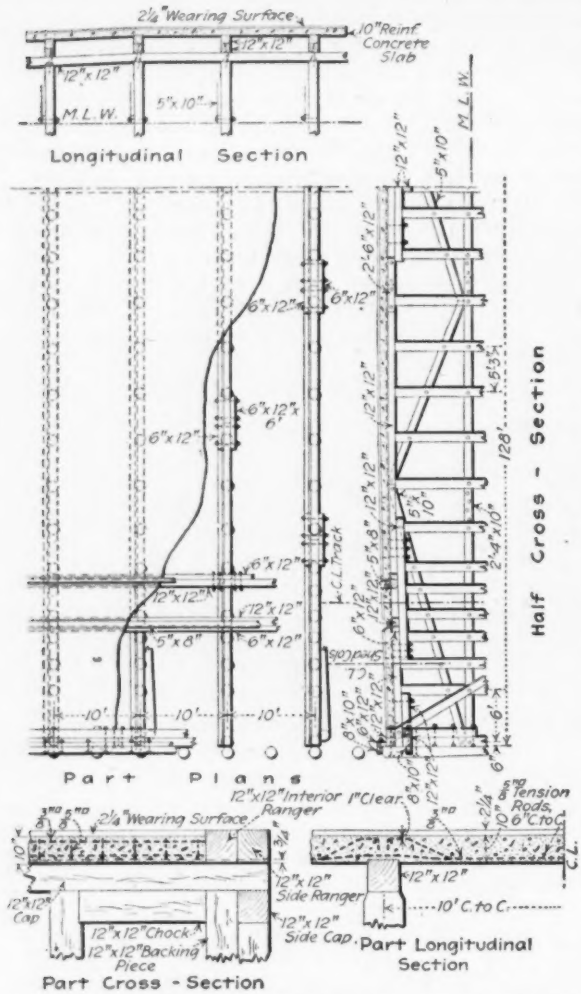
CONCRETE TERMINAL WAREHOUSE HAS MANY NOVELTIES IN FREIGHT-HANDLING METHODS

operation. The electric lighting system will be of the latest design to meet the requirements of modern steamship methods.

The two units of the warehouses now being built are in effect one building, separated through the center by a fire-wall. They are throughout of reinforced concrete using Havemeyer bars. The whole structure is 120 x 160 ft. in plan and seven stories high. A four-way flat-slab floor known as the Simplex system of design, is used throughout with circular interior spiral columns and rectangular exterior columns, the curtain walls being of concrete. Each of the column footings rests on MacArthur pedestal concrete piles.

The layout of the building is extremely novel. In the first place the whole first or ground floor is open to the controlled by a traveling electric hoist which runs along a reinforced-concrete cantilever extending out from the roof of the building. Material to be brought in can be placed alongside of the railroad tracks or left in the open trucks or cars and elevated by means of these traveling hoists to the extending platform, whence it can be rolled at will inside to any section of the floor.

In addition to this means of entrance, there are up the middle of both faces of the building, that is in the two middle panels, wide openings in which are sliding doors. The material to be brought in through these doors is lifted by whip hoists attached to permanent brackets immediately above the two central panels. These hoists are to be controlled from the ground in the usual manner. The traveling electric hoist will



PIER GOOD EXAMPLE OF TIMBER CONSTRUCTION WITH CONCRETE FLOOR

when the building across the way is completed, be controlled from an extended platform at about the second story of that building. Pending the construction of an opposite building, the traveling hoist on the first unit will be controlled from a temporary house on the ground, directly opposite the front of the building. Meanwhile, a similar platform has been built on the inside face of the structure now under way from which the hoists on the opposite building will be controlled. This method has been developed because it insures the operator seeing all of the operations. If he is working from the building into which the material is being hoisted, his view is often obscured.

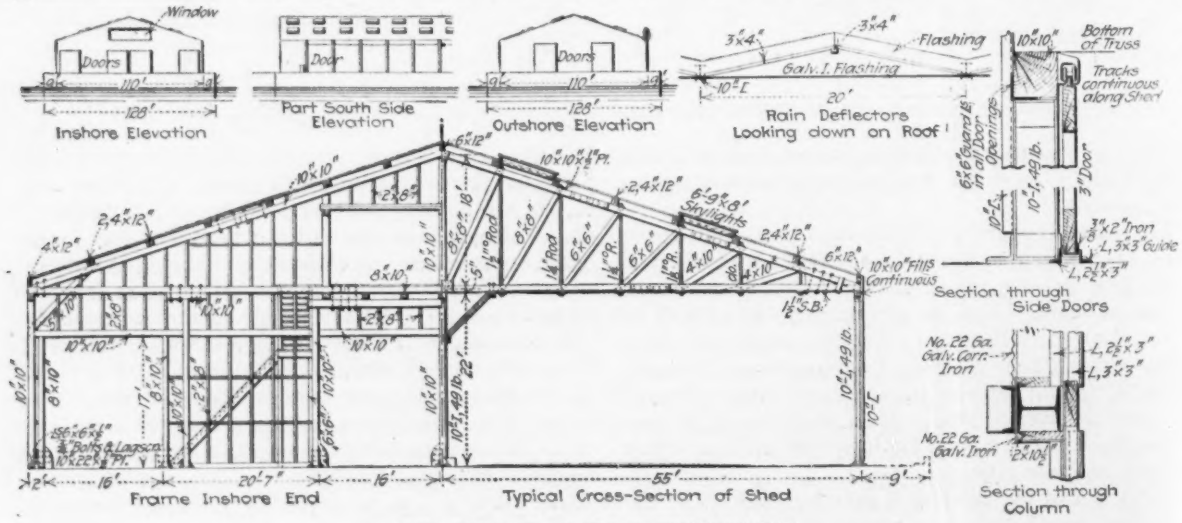
Another entrance to the floors is had by an elevator in the front part of the building, which, it will be noted, is completely inclosed with a fire-wall opening into each of the two halves of the unit. This separated section has also a stair opening and a spiral chute for lowering freight from any of the floors. In addition, there is a further stair opening in the rear of the building, also separated by fire-walls.

The explanation for such a variety of mechanical equipment is given in the statement that the commodities to be handled in these warehouses vary so much, in size and weight, that three independent methods of elevating and four of lowering are necessary to obtain the proper efficiency of modern methods, especially when freight must be handled simultaneously in and out of warehouse, from trucks, lighters, cars and piers.

The elevator will be of sufficient size to carry two electric trucks, each holding two tons of freight, while whip hoists of higher speed will have a capacity of only one ton. The overhanging platforms are so arranged as to permit of electric trucks being operated from each floor, independent of elevator or whip hoist service. The spiral chute will be of special design and size to provide for speedy delivery of package freight where other methods are not required.

The Pouch Terminal is under the immediate direction of A. B. Pouch, president of the American Dock Co., New York City, who is responsible for many of the details which have been worked out from ideas of efficiency he has gained by years of practical operation of terminals and a close study of port facilities at home and abroad.

The designs for the bulkhead and pier were originally prepared by Chandler Davis, who was unable to com-



PIER SHED IS OF WOOD THROUGHOUT

plete his plans on account of being called to Government service. W. J. Barney, consulting engineer, New York City, completed the details and supervised the work started by Mr. Davis. The bulkhead was constructed by the General Contracting & Engineering Co. The pier itself is being built by Anderson & Wheeler of St. George, Staten Island. The plans for the first unit of warehouses were prepared by Alex. Thomson, Jr., chief engineer of the Concrete Steel Co., of New York City, and the general contractor for the building is the Fairibault Building Corporation, also of New York.

Eight-Inch Hardwood Rollers Take 12 to 18 Tons per Foot

Maple, Sycamore and Oak Tested—Quarter-Cut Rollers Prove Stronger Than Pole Rollers—Safe Loads Recommended

By A. B. McDaniel
Professor of Civil Engineering, Union College, Schenectady, N. Y.

WOODEN rollers have been used since the days of the ancients in moving heavy loads, and are in general use today, for supporting excavating machinery on wet soils, and for other purposes. Very little has been known as to their strength. The tests described were made to furnish data on this subject.

The rollers were hand-hewn out of small timber, and were painted with one coat of red lead. Three 8 x 36-in. specimens of each of the following kinds of wood, hard maple, burr oak, sycamore, and pin or water oak, and one 6 x 36-in. specimen of birch (thirteen specmens in all) were tested.

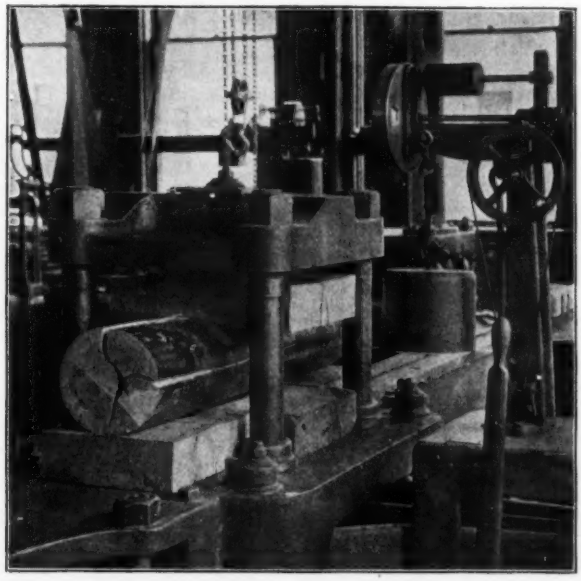
All the rollers were furnished by R. H. and G. A. McWilliams, drainage contractors of Chicago, and were of the type used by them for the support of dragline excavators. The tests were made by the writer under the general supervision of Prof. H. F. Moore, in the Materials Testing Laboratory of the University of Illinois.

Each roller was tested for static-compression strength in a 200,000-lb. standard testing machine. The specimen was bedded on three short 4 x 12-in. oak planks laid transversely, and the load was applied through a single similar transverse plank on top of the roller. Thus only the middle 12-in. length was loaded, while the roller was bedded on its whole length. The load was applied at the rate of 0.1 in. per minute, and readings of the vertical motion of the bearing head were taken at each 5000 lb. Observations were taken of the load which produced an initial crack in the specimen, the character and location of further cracks under increased loads and the method of final failure.

The results of the tests, briefly tabulated herewith, show the following noteworthy facts:

Ten specimens which were "pole" pieces, or rollers cut from trees just large enough to make one piece, failed by shearing vertically, the final break passing through the heart of the section. Specimens 2, 12 and 13 were "quartered" pieces and the load was applied in the general direction of the grain. In these the initial crack was horizontal and extended across the section near its center; further application of the load produced a considerable spreading of the specimen, and final failure occurred at a load 30% to 50% greater than that required to crush a "pole" roller.

The hard maple and sycamore rollers had about the same ultimate strength. The burr oak and pin oak rollers showed about 40% greater strength.



ROLLER AFTER CARRYING NEARLY 45 TONS IN THE TESTING MACHINE

These tests were too limited in scope to furnish conclusive results, but it is believed that they do furnish suggestive information as to the strength of rollers. This series of tests was made under static loads, and it is evident that under moving loads the specimens would have failed under lower loads. The writer has

DIFFERENT KINDS OF FAILURE EXHIBITED BY THE VARIOUS ROLLERS TESTED

observed that in moving a dragline excavator the front roller of a group crushed just as the machine began to move. It is probably true that the greatest pressure on a roller will occur at the commencement of motion.

Hence, in selecting the safe load for rollers a large factor of safety should be applied to the static strength results.

Assuming a factor of safety of 10, the following are suggested as safe loads for "pole" rollers of 8-in. diameter:

Hard sample Sycamore	2,500 lb. per lin.ft.
Burr oak Pin oak	3,500 lb. per lin.ft.

CRUSHING TESTS OF 8-INCH WOODEN ROLLERS

NOTE.—All rollers were 8 in. diameter, 36 in. long, except for variations in diameter noted. Load was applied over the middle foot of the 3-ft. length.

	Material	Weight Lb.	Load at First Crack Lb.	Ultimate Load Lb.	Average Ultimate Compr. Load per Foot of Length, Lb.	Under Ult. Load In.	Method of Failure
1	Hard maple	54 25	70,000	72,000		1 1/16	Vert. Shear
2	Hard maple	50 00	114,000	*125,000	25,670	1 1/2	Horiz. Shear
3	Hard maple	52 50	75,000	82,000		1 1/8	Vert. Shear
4	Sycamore	41 50	45,000	80,000		1 1/16	Vert. Shear
5	Sycamore	46 00	30,000	61,800	24,630	1 1/16	Vert. Shear
6	Sycamore	40 50	40,000	80,000		1 3/16	Vert. Shear
7	Burr oak (8¼ in.)	67 00	80,000	107,000		1 1/16	Vert. Shear
8	Burr oak	64 00	50,000	111,700	35,200	1 1/16	Vert. Shear
9	Burr oak (8¼ in.)	73 50	40,000	98,000		1 1/2	Vert. Shear
10	Pin oak	65 75	No record	97,000		1 1/16	Vert. Shear
11	Pin oak	65 50	60,000	119,000	36,000	1 1/16	Horiz. Shear
12	Pin oak (8¼ in.)	67 50	†80,000	*134,000		1 1/16	Horiz.
13	Birch (6 in.)	28 00	†25,000	80,000		2 1/16	Shear

* Quartering pieces. Results not used in computing the average, which gives the result for vertical shear failure.
† Quartering piece.

Local Interests Have Obligation in Waterways

In a letter to Secretary of War Baker, the Hon. John H. Small, Chairman of the Committee on Rivers and Harbors of the House of Representatives, calls attention to the necessity of local agencies furnishing a considerable contribution to the increase of waterway transportation. The letter says it is self-evident that the mere deepening of an entrance to or the increasing of the depth and area of a harbor, or the improvement of a channel of an interior waterway, will not alone establish water transportation. However, these are the only things that the Federal Government can do. They simply provide the basic necessities, but there are additional facilities which must be provided for the establishment of the method or system of communication. First, there must exist the demand for the movement of products; second, there must be water terminals physically connected by belt-line railway and railroads serving the community, or with highways radiating therefrom, and equipped with proper handling machinery; third, there must be established lines of water transportation with sufficient capital and organization; fourth, there should be complete coördination between the water transportation lines and the railroads. It is the opinion of the members of the House Committee that all of these things must be provided by the local interests, either the states or the municipalities. The committee feels that unless the states and municipalities enter into the provision of such facilities to a much greater degree than they have in the past the Federal Government cannot be expected to continue to provide the basic water facilities—that is, the channels and harbors.

Floating-Crest Gates Used on Sherburne Lakes Dam

Automatic Movable Crest, with Radial Top Plate and Cylindrical Downstream Plate, Is Devised for Isolated Site

TO MEET the requirements for the safety of the earth dam at the Sherburne Lakes, on the Milk River irrigation project of the U. S. Reclamation Service, in Montana, and to satisfy the demand for a large reservoir capacity, a freeboard of 10 ft. was stipulated—this to exist during stages of maximum flood, as well as of maximum storage. This necessitated a movable crest. As the reservoir was in the mountains far from human habitation, it was deemed unsafe to put sole reliance on the services of a gate tender. Automatic gates were necessary—gates that would be simple in mechanism, reliable in operation and sensitive in regulation of the maximum storage level. The type selected is a sector, hinged upstream, with a radial top plate and a cylindrical downstream plate, with a longitudinal seal both for this plate and for the line over the hinges, and with end seals at the pier faces. A joint patent on this form of movable crest will be taken out by Gen. W. L. Marshall and F. Teichman, of the U. S. Reclamation Service. The device is described by Mr. Teichman as follows:

For an assumed height of 5 ft. of this crest it had to have a length of 160 ft., to accommodate the maximum flood. This length was divided into four unit crests of 40 ft. each. Each 40-ft. crest unit is made up of two identical halves, 20-ft. long, connected, just within the cylindrical plate, by a tangential link which forces both halves to move together but gives to the sectors a certain freedom in expansion and in motion, affords greater ease in alignment and installation, and avoids field riveting. Each 20-ft. sector has a central air-tight caisson of such flotation, in submergence, that its moment relative to the hinge axis exceeds the moment of the weight of the sector.

Pipe systems, one located in a chamber of each abutment and two in a chamber of the central pier, and each connecting with the pit in which its sector moves, furnish the means for the operation of the four sectors. A siphon (under a patent of General Marshall) is made a part of each pipe system and furnishes the automatic principle of the mechanism.

As long as the pressure of the water below the sector (in the pit) corresponds to the level of the water above, the positions which the sector assumes, as the reservoir level rises to that of the permanent crest and then above it until the sector reaches the stops for its highest position, are with the apex above water level; and the positions are the same as if the water downstream from the sector stood as high as upstream (because the water pressures on the cylindrical plate of the sector do not affect the equilibrium of the sector). This is also true of the stop forces for the higher reservoir levels.

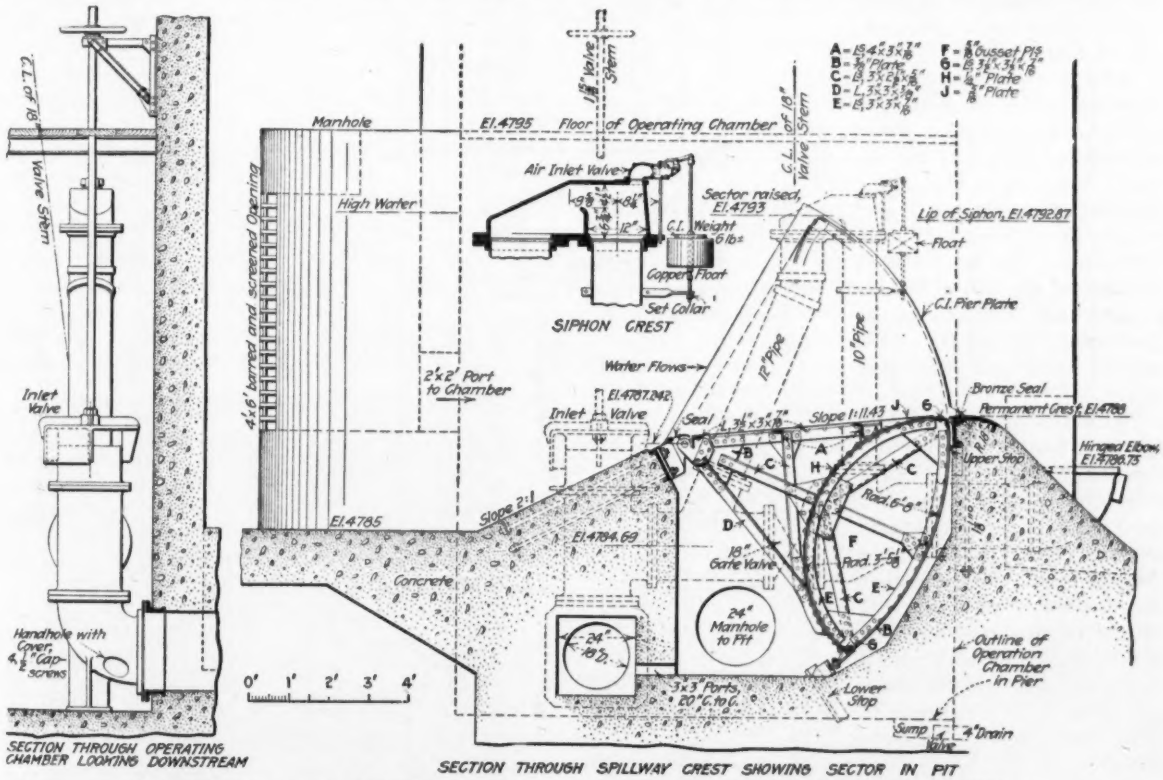
For any of the positions through which the sector passes as it lowers, in flood, from its highest position under action of the siphon, or as it rises, against the flood waters, from lowest to highest position when the action of the siphon is broken, there exists a certain

"reduction" (of pressure underneath the upper plate) for which the sector is in equilibrium. For the Sherburne sector as designed, this reduction is 5 in. for the lowest position, 6¼ in. for the highest position of sector and 6½ in. for a position about 15° from the highest position. This variable reduction represents the force available for raising the sector, when, after release by the automatic break of siphon, the sector moves upward through the flood waters; and it may be said that these available forces have a variation similar to that of the resistances; the mechanical friction is the highest for highest position of sector, diminishing as the sector lowers (because the hinge reactions vary in that manner) and the hydraulic resistance (the impact of the approaching flood waters) is greatest for mean positions of the sector. A 5-, 6¼- or 6½-in. reduction represents a tangential force, with radius of 6 ft. 8 in. (that of the circular plate), of 87, 108 and 113 lb. respectively, per lin.ft. of sector. These forces are larger than required. They should be large enough to move the sector against friction and hydraulic resistance and to keep the sector in highest position and against the stops when under wave action, but any great excess above that merely exaggerates the stresses at hinges, at stops and in the sector itself. The tight caisson of the sector is provided with a drain pipe to carry its leakage. This pipe has a short extension into the caisson by means of which a certain amount of water is always retained in the caisson. In this manner the available force for moving the gate upward or for holding it against the upper stops can be made anything less than the above given values that may be desired.

For automatic action the gate valve is closed, the intake valve adjusted to a certain position, and the float placed so as to break the siphon when the flood level by a temporary opening of one or more crest units has been lowered to a certain predetermined elevation.

Let S be the sum of all pit leakage, having the positive sign if the leakage out of the pit predominates, let Y be the water discharged by the siphon, and D the displacement, that is, the flow per second into or out of the pit due solely to the up or down movement of crest and let Q be the water passing the intake valve.

For automatic down movement of crest, Q equals $S + Y - D$. While the sector is being held in down-position for passage of flood waters Q_1 equals $S + Y$ and when the sector rises after break of siphon Q_2 equals $S + D$. While Q_1 passes the intake valve the loss of head is somewhat larger than the reduction of equilibrium, and for passage of Q_2 the loss of head is somewhat smaller than this reduction of equilibrium. Therefore $Q_1 > Q_2$ and if the displacement for up-motion of crest is to be about the same as for down-motion (D having the same value in expressions for Q_1 and Q_2) then it follows that $Y > 2D$. The effective head of siphon being known, and the efficiency of siphon being assumed (40 to 50%), Y may be figured, then D assumed, and, for certain assumption of S, the values of Q_1 and Q_2 may be known. Also the adjustment of the intake valve may be assumed which for the passage of Q_1 and Q_2 produces certain required friction losses. The final adjustments can be made only under actual test. The expression for Q_2 will lead to the determination of the reduction (considerably larger than that of equilib-



NEW AUTOMATIC CREST GATE IS OPERATED BY AIR-TIGHT CAISSON AND SIPHON

rium) which obtains (for the intake valve adjusted for Q_1 and Q_2) while flood waters pass the crest in a down position.

If a certain adjustment of valve does not give the desired relation between rate of up-motion and rate of down-motion of the sector then this adjustment is changed. For instance, by opening the valve wider the quantities Q_2 and Q_3 increase, since the friction losses of passage through valve must remain unchanged. The values S and Y also remaining practically unchanged, it follows that the displacement for down-motion must decrease and for up-motion must increase. Thus, if desired, the rates of up and down motion of sector can be equalized. This uniform rate of displacement is somewhat smaller than half the discharge of the siphon, and if this rate should be greater than desired it is corrected by placing a light steel disk with reduced orifice between the flanges of the up-leg or down-leg of the siphon or both, thus reducing Y and thereby D.

Of course, the crest can be operated at the will of the attendant and without the siphon action by the use of the intake valve and the gate valve.

The outlet of the pipe system is so located that, for any elevation of water level in the reservoir between permanent crest and apex of movable crest in highest position, the apex of crest will be higher than the water level. If it is desired to discharge over the permanent crest with reservoir levels only slightly above this crest it is necessary to raise the hinged discharge elbow.

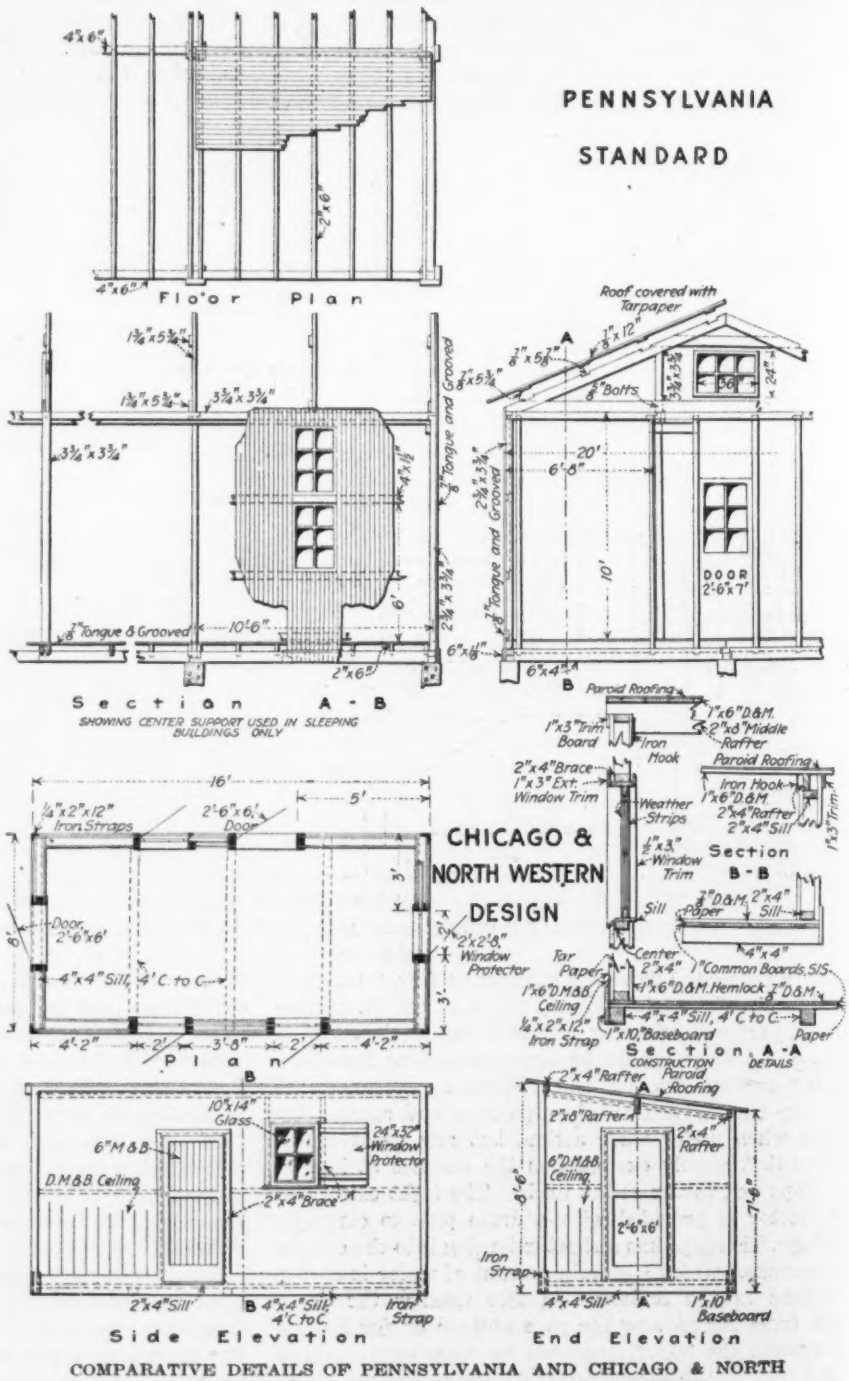
Sewers Cleaned After Trees Had Been Cut

After sacrificing some large and handsome shade trees in an attempt to prevent sewer clogging by roots, without stopping the trouble, the City of Goshen, Ind., had the roots and other débris removed by the Turbine Sewer Machine Co., Milwaukee. After the trees had been cut down an unsuccessful attempt was made to kill the roots by boring holes in the stumps, pouring in acid, and plugging the holes.

Portable Units Form Buildings for Labor Camps

Sectional Bunkhouses More Convenient and Sanitary Than Box-Cars or Shacks—Cost 7½ Cents per Cubic Foot

BUNKHOUSES and other camp buildings of sectional knockdown construction are being introduced for the accommodation of workmen on construction jobs and railway maintenance, and in many ways are considered



COMPARATIVE DETAILS OF PENNSYLVANIA AND CHICAGO & NORTH WESTERN DESIGNS FOR PORTABLE CAMP BUILDINGS

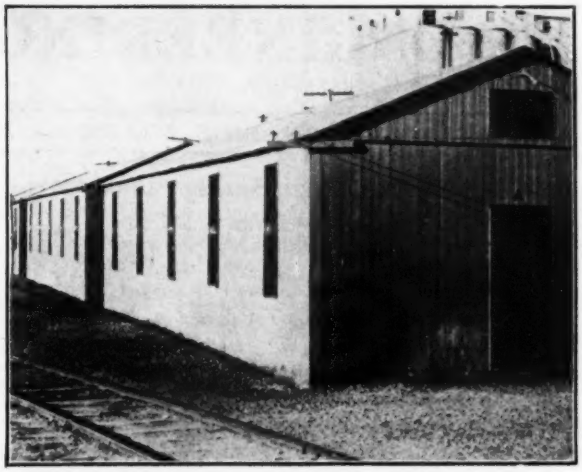
an improvement upon the common method of housing the men in old box-cars or rude shanties. The standard design adopted by the Pennsylvania R.R. for wooden buildings of this sort is shown herewith, and was referred to in *Engineering News-Record* of Nov. 1, p. 832. Details are also shown of a type used by the Chicago & North Western Railway.

The Pennsylvania buildings are of light framing, with sheathing of tongued-and-grooved white pine, and roof panels of plank covered with tar paper. They are built in 10½-ft. lengths, and have a uniform width of 20 ft. and height of 16 ft. from floor to ridge. The exterior is covered with pebble-dash roofing paper. For semi-permanent structures, as at railway shops, the floors are set on concrete piers about 18 in. above the ground, and roof gutters and downspouts are provided.

Typical construction is shown by the drawing, and the views show exteriors and an interior at camps near Philadelphia. The buildings can be made of any desired length, and equipped for various uses. The bunkhouse has usually five sections. It has steel double-deck bunks, and is fitted with lockers and stationary washstands supplied with running hot and cold water. Shower baths are provided whenever possible. A 73½-ft. mess-room has two sections (21 ft.) for the kitchen, and five sections (52½ ft.) for the dining room. This latter has six rows of benches and two tables. The commissary building for the storekeeper or timekeeper has two sections.

Portable sectional buildings of simple construction, intended generally for maintenance-of-way and extra

DOUBLEDECK BUNKS AND STATIONARY WASH BOWLS IN HOUSES



PENNSYLVANIA STANDARD BUNKHOUSES HAVE GABLE ROOFS

gangs, have been designed by J. S. Robinson, division engineer of the Chicago & North Western Ry. These are in separate units 8 x 16 ft., 7½ to 8½ ft. high, as shown.

Transverse sills spaced 4 ft. on centers carry a double floor composed of two layers of planks with tar paper between them. The sides have sills and girts, with 1-in. sheathing inside and outside and tar paper behind the outer sheathing. The rafters are notched to fit over the sides and act as braces. The roof has a single layer of plank covered with roofing felt. The design is simplified by the use of a shed roof instead of the gable roof of the Pennsylvania design. Doors, windows and shutters are provided as shown.

Sides, ends, floor and roof form separate sections or panels. These are packed flat for shipment, and material for four buildings can be transported easily on a flat or gondola car. When erected, the sections are put together with hooks and eye-screws. The separate panels are readily treated with disinfectants, applied by brush or spray, and this work is easier and more effective than disinfecting a car. Cost of construction is about 7½ cents per cu.ft. Unloading and erecting costs about $5 per unit, dismantling and loading the same.

Each unit used as a bunkhouse will accommodate eight men, and the arrangement facilitates the provision of separate quarters for men of different colors or nationalities. The buildings may be equipped as kitchens, mess rooms, storehouses and offices. They can be erected at any suitable site, without the necessity of building spur tracks, and their transportation requires no special train service.

Canadian Provinces Connected by New Road

The provinces of Alberta and British Columbia have recently been connected by a road following the route to the south of Crows Nest Lake, which has resulted in abandoning the old road over the summit at Crows Nest Pass. The new road passes by easy grades over the summit of the Canadian Rockies, on the boundary line between Alberta and British Columbia. In addition to this, there are now a number of projects throughout the Kootenay District in British Columbia which are under construction.

ENGINEERING LITERATURE

A REVIEW OF BOOKS AND A LISTING OF NEW PUBLICATIONS

Structural Design Simply Stated

Reviewed by WALTER S. EDGE
Consulting Engineer, 42 Broadway, New York City

PRACTICAL STRUCTURAL DESIGN: A Textbook and Reference Work for Engineers, Architects, Builders, Draftsmen and Technical Schools; Especially Adapted to the Needs of Self-Tutored Men—By Ernest McCullough, C. E., M. Am. Soc. C. E. New York: U. P. C. Book Co., Inc. Cloth; 6 x 9 in.; pp. 303; illustrated. $2.50.

The author has produced a clearly written, concise treatise dealing with the practical side of structural design, suited to the working student whose knowledge of mathematics does not extend beyond arithmetic. This summarizes the work but does not do it justice.

If in our college days one of us had dared to tell our professor of mechanics or structures that a really comprehensive text could have been written without the use of calculus or algebra, he would certainly have been classed with the heretics. The writer has always felt, however, that such a thing could be done and now his belief is realized in Mr. McCullough's admirable work.

As is true of several other successful technical works, this book is an outgrowth of a teaching course given by its author. A large part of the subject matter was given in a series of articles which appeared in the "Building Age" in 1914.

In the preparation of any course of instruction the teacher must draw heavily on other published texts, so naturally much of the material here presented will be familiar to experienced readers. Two circumstances differentiate this from the general run of books and tend to explain its special merit. The first is that the students in the night school for whom the original material was prepared were drawn largely from the ranks of draftsmen in the offices of engineers, contractors and "material men" who were eager for the knowledge which would enable them to better their condition but who would be discouraged by the effort required to obtain this knowledge through the language of higher mathematics. The second is that the author took up teaching as a relaxation from the busy life of a practicing engineer and for that reason approached the problem far better equipped in a practical way than the great majority of the authors of our textbooks.

Although containing only 293 pages, it is difficult to find a phase of structural engineering such as is likely to be encountered in the city practice of a designing engineer which is not covered in a satisfactory manner.

Particularly interesting and instructive are the passages which deal with the relation of the engineer and the building departments of our larger cities. This is a subject which most texts ignore entirely or give but passing attention. As a result many men come from college with but a hazy idea of what a building code means. They are apt soon to discover, however, that it is a very real though, in some cases, arbitrary law which must be obeyed.

The reviewer believes that technical and trade school teachers, both night and day, will find this book a very real help to them in their work, either as a text or as a guide and inspiration. In his own engineering practice the reviewer is using the book as a reference work. He finds that, on account of the clearness and simplicity of the explanations given it has met with favor at the hands of designing engineers who have used it.

Timber-Frame Construction

TIMBER FRAMING—By Henry D. Dewell, Assoc. M. Am. Soc. C. E.; Structural Engineer for Alaska-Yukon-Pacific Exposition; Chief Structural Engineer for Panama-Pacific International Exposition. San Francisco, Calif.: Dewey Publishing Co. Cloth; 6 x 9 in.; pp. 275; illustrated. $2.

War-time needs have brought timber-frame construction to a position of importance comparable to that of three or four decades ago. At the same time they bring into view the lack of good engineering knowledge concerning design in timber. Construction that violates one or another or several principles of sound designing is common. Now the necessity is again opening our eyes to the merits of timber-frame construction we are coming to appreciate the importance of studying details in wood with greater care. Mr. Dewell's book furnishes an indispensable help in this direction.

We are likely to overlook the immense contribution made to timber construction through the several large expositions of the last fifteen years. The Panama-Pacific may probably be credited with much of this contribution, and, in turn, Mr. Dewell, as its chief structural engineer, is entitled to a large share of the credit. Substantially all the experience that that great enterprise yielded, together with some important auxiliary testing, is brought together and applied to practical use in the present book.

To begin with, the author shows a healthy spirit of caution and conservatism in his discussion of unit stresses. Not that he goes to the extreme of the old-time flat 1000-lb. unit stress, but his emphasis on the influence of ordinary defects and variations of quality leads him to give warning against indiscriminate use of the maximum unit stresses that have been recommended for high-grade bridge timber. Even more commendable caution is shown in a recommendation to modify allowable units according to the nature of the detail of the joint.

The treatment of the elements of joints, and then of various types of joint themselves, is of a kind adapted to build up the user's knowledge of timber construction on a new and fruitful basis. Here are brought together the essential contributions made by the large expositions.

The rest of the book—the last third—is also of value, but, dealing more broadly with elements of timber frames, it is less exhaustive than the portion that precedes. Here we find warning against longitudinal shear in dry timbers, for example, but no quantitative estimate of the amount of weakening that should be allowed for by the prudent engineer. Again, we find

reference to bracing trusses, but no such full treatment of the bracing of timberwork as the complexity and trickiness of the subject might demand. The relation of timber design to decay and to fire danger, and a number of other matters of general bearing, fail of mention or at least of full treatment, which in a measure deprives this last part of the book of the treatise character.

In general, it must be said that the book is absolutely indispensable to everyone intending to design in timber. It leaves the reader with a feeling, moreover, that further books will be written in future on the subject of timber design—and this last is evidence of the high quality of the book.

From Coal Pile to Flywheel

STEAM POWER PLANT ENGINEERING—By George F. Gebhardt, M.E., A.M. Professor of Mechanical Engineering, Armour Institute of Technology, Chicago, Ill. Fifth Edition. New York: John Wiley & Sons, Inc. London: Chapman & Hall, Ltd. Cloth; 6 x 9 in.; pp. 1057; illustrated. $4.

Lengthy and appreciative reviews of the first and the extensively rewritten fourth editions of this book appeared in these columns Nov. 12, 1908, p. 534, and Nov. 13, 1913, p. 1000. In one of these notices the book was characterized, in effect, as an encyclopedic treatment of its subject from the coal pile to the flywheel.

Through the medium of his preface the author states that the same general treatment has been followed in this as in the earlier edition. Besides laying particular stress upon fuels and combustion, supplementary chapters have been supplied on elementary thermodynamics, properties of steam and properties of dry and saturated air. With these and other changes and additions, the scope of the work has been greatly enlarged and, except for "a few minor sections, the entire text has been rewritten." Further studies of the subject are "facilitated by numerous references to current engineering literature"—a most commendable feature.

Author and publisher alike are to be congratulated upon their continued and successful prosecution of the large task of keeping so comprehensive a book as this one up to date.

Hydraulic-Mining Debris

HYDRAULIC-MINING DEBRIS IN THE SIERRA NEVADA—By Grove Karl Gilbert, Washington, D. C.: The Superintendent of Documents. Paper; 9 x 12 in.; pp. 154; illustrated. 50 cents.

Based principally upon field work done from 1905 to 1908, but supplemented with later observations down to 1914, this monograph deals chiefly with the geologic and physiographic aspects of the hydraulic mining débris problem in the Sacramento and San Joaquin valleys. When the matter was referred to the U. S. Geological Survey in 1904 it was proposed that a threefold study should be made to include field work, laboratory investigations, and the engineering study of the débris problem. A report on "The Transportation of Débris by Running Water, Based on Experiments Made with the Assistance of E. P. Murphy," was published by the author of the present monograph as Professional Paper 86 (1914) of the U. S. Geological Survey. The contemplated engineering studies were never made owing to the fact that the Reclamation Service was separated from the Geological Survey and made a bureau of the Department of the Interior in 1906.

Mr. Gilbert's monograph opens with a review of hydraulic mining in the Sierra Nevadas. It then deals with the encroachment of débris on valley lands, land subsidence, changes in conditions of the rivers from artificial causes, changes in the conditions of the bays receiving the river discharges, the quantity and distribution of detritus, specific detritus studies in the lower Yuba River, including an account of the barriers built there and the results they gave, flood control, the relations of the débris movement to the Golden Gate bar at the entrance to San Francisco harbor, and finally the outlook for hydraulic mining.

Originally a conflict between the interests of the hydraulic miners above and the agriculturists and town dwellers on the lower levels, the questions at issue are now more particularly between those who wish to use water for hydraulic mining and for hydroelectric power on the one hand, and on the other the agricultural and commercial interests centering in the marshlands now being reclaimed around San Francisco Bay and in San Francisco Bay and harbor as a shipping center. Summarizing, Mr. Gilbert says:

"The stress which caused the restriction of hydraulic mining no longer exists. Under conditions to be created by works for the control of floods the capacity of valley rivers for transportation of débris will be increased, so that mining might be partly resumed without prejudice to any valley interest except navigation. The important interest which now dictates that débris should be controlled is that of the commerce which traverses the Golden Gate. The possibilities for resumption of mining on a large scale, with storage of débris, lie in coöperation with irrigation and electric power development for the control of Sierra streams."

Folwell's Water-Supply Rewritten

REVIEWED BY GEORGE W. FULLER
Consulting Engineer, 170 Broadway, New York City

WATER-SUPPLY ENGINEERING: The Designing and Constructing of Water-Supply Systems—By A. Prescott Folwell, Member of the American Water-Works Association. New York: John Wiley & Sons, Inc. London: Chapman & Hall, Limited. Cloth; 6 x 9 in.; pp. 484; illustrated. $3.50.

It is 18 years since the first edition of this book appeared. The present edition has been practically rewritten so as to make it essentially a new book. The chapters on water purification and the quality of water have been entirely rewritten and much elaborated, occupying now nearly 80 pages. The chapter on pumping machinery, 66 pages, has also been rewritten. The size of the book has been kept within moderate limits by the complete omission of the chapter in earlier editions dealing with maintenance and by condensing the earlier chapters on construction to about 20 pages.

The book is written in excellent style with a clearness and directness that assures its success in the hands of students and of those practitioners desiring the essential evidence on the more important phases of water-supply engineering. Although not intended for him the specialist will find the book of considerable interest for general reference.

The fundamental principles of water purification by means of sedimentation, filtration, coagulation, chlorination, and treatment with other chemicals, are set out with unusual clearness. Up-to-date means of applying chemicals are described at length, although very little

attempt is made to describe other than their more general features

The broad viewpoint of what constitutes good water-supply engineering is recited in an admirable manner and the reader is not left in doubt as to what constitutes a good supply, reasonable in quantity and quality. The methods of investigating the quantity and quality of a proposed supply from ground-water and surface sources, are made plain both as regards the yield and quality of water to be expected therefrom.

A good chapter of 24 pages is given on rainfall. The effect of evaporation on storage is explained, both in its relation to surface supplies and ground-water sources.

The superintendent will find interesting data as to the waste of water, requirements of the underwriters as to water-supply for fire protection, variations in the consumption at different hours of the day for different seasons of the year, and the factors to be considered in forecasting future consumption.

Taken as a whole, the book makes a very favorable impression, and should prove to be of distinct value to all students and practitioners interested in water-supply engineering.

A Brief for Private Ownership

A MUNICIPAL EXPERIMENT, OR THE HALL OF RECORDS POWER PLANT—By Reginald Pelham Bolton. New York: The Bureau of Public Service Economics, Inc., 55 Liberty St. Cloth; 5 x 8 in.; pp. 221; illustrated. $1; $1.10 postpaid.

Regarded as a brief for private rather than municipal ownership, and for central rather than isolated station electric light and power and steam heating plants, this is a commendable piece of work. The author has presented in small compass and readable form a digest of a large volume of material on the cost of installing and operating the lighting, heating and elevator-service plant for the New York City Hall of Records and some near-by buildings. The original documents in the case were the result of an agreement between the Borough of Manhattan, the Department of Water-Supply, Gas and Electricity of New York City, the New York Edison Co., and the Bureau of Municipal Research to make a study and test of the plant named. The operating test was made in 1913. Mr. Bolton was one of the "engineers charged with the duty of conducting" the test. He presents a concise summary of the nature and result of the test and makes skillful use of the data to show up this "municipal experiment" in a bad light. To what extent he could be answered by a brief for the municipal ownership side, we do not pretend to say. Certainly, the evidence as he presents it is not favorable to municipally-owned isolated stations.

Sanitary Classics Made Available

STATE SANITATION: A Review of the Work of the Massachusetts State Board of Health—By George Chandler Whipple, Professor of Sanitary Engineering in Harvard University and the Massachusetts Institute of Technology, Member of the Massachusetts Public Health Council. Vol. II. Cambridge, Mass.: Harvard University Press. London: Humphrey Milford, Oxford University Press. Cloth; 6 x 9 in.; pp. 441; illustrated. $2.50.

In the second of his three volumes epitomizing the work of the Massachusetts State Board of Health, Professor Whipple devotes most of his space to 34 reprints and abstracts of papers and special reports scattered through the many volumes published by the board from 1869 to 1914. In addition, Professor Whipple presents many very brief abstracts of scientific articles and reports published during the period named.

The first of the reprints is an address on "State Medicine" delivered by Dr. Henry I. Bowditch at the first meeting of the board, Sept. 15, 1869. Following this a circular letter addressed by the board to "The Mayor and Board of Health of Every City, the Selectmen of Every Town, Every Member of the Legislature of 1869, and Every Clergyman and Physician in Massachusetts." It contains the following sound doctrine: "We believe that all citizens have an inherent right to the enjoyment of pure and uncontaminated air, and water, and soil; that this right should be regarded as belonging to the whole community; and that no one should be allowed to trespass upon it by his carelessness, or his avarice, or even by his ignorance."

Extracted from the 1878 report of the board is a paper entitled "The Filtration of Potable Water," written by Prof. Wm. Ripley Nichols. This is one of many classics on water and sewage treatment which are reprinted in full or abstract in this volume. Some of the other papers and authors are: "Suggestions As to the Selection of Sources of Water-Supply," by F. P. Stearns; "Typhoid Fever in Its Relation to Water-Supplies," H. F. Mills; "The Chemical Precipitation of Sewage," Allen Hazen; "Microscopical Analysis," Wm. T. Sedgwick; "Investigations Upon Nitrification and the Nitrifying Organism," E. O. Jordan and Mrs. E. H. Richards; "The Interpretation of Water Analyses," T. M. Drown; "Some Physical Properties of Sand and Gravel, with Special Reference to Their Use in Filtration," Allen Hazen; "Examination of Sewer Outlets in Boston Harbor," X. H. Goodnough; "Review of Twenty-One Years' Experiment Upon the Purification of Sewage at the Lawrence Experiment Station," H. W. Clark and Stephen De M. Gage.

Equally important writings and authors as well known in other lines of health board work could be given if space permitted. Enough have been cited, we trust, to bring again to the minds of our readers the many contributions made by the Massachusetts State Board of Health to public sanitation and the value of the work done by Professor Whipple in making readily available to all these classics in sanitary engineering and public health.

Intimate Studies of a Water-Supply

RIVERS AS SOURCES OF WATER SUPPLY: By Alex. Crulkshank Houston, M.B., D.Sc., F.R.S.Ed. Director of Water Examinations, Metropolitan Water Board. First three chapters reprinted from "The Journal of State Medicine," November and December, 1916, and January, 1917. London: John Bale, Sons & Danielsson, Ltd. Cloth; 7 x 10 in.; pp. 96; illustrated.

For many years Dr. Houston has been closely studying the character of the water-supply of London, England, as has been evidenced by his water-research laboratory reports and by his "Studies in Water-Supply." (The latter was reviewed by Geo. W. Fuller in this section, Apr. 15, 1914, p. 877.) The major part of his studies have related to the River Thames, which is the main water source of London. The present volume, which deals almost wholly with Thames water, originated in the Harben Lectures for 1916 before the Royal Institute of Public Health, which appeared in "The Journal of State Medicine" November and December, 1916, and

January, 1917. To the three lectures has been added a chapter on "Sterilization."

The author first exhibits the physical, chemical and bacterial quantities of Thames River water as affected by rainfall and by seasonal flow. He then presents a most interesting chapter summarizing the results of searches for stoeptococci, typhoid and Gärtner bacilli and the vitality of the cholera vibrio and the typhoid bacillus in Thames water. Most readers will be surprised to learn that Thames water evidently contains only one part of *fresh* excremental matter in 22,000,000 parts and that one might drink 15 liters or nearly 3.85 U. S. gal. of average Thames water without swallowing a single typhoid germ. The second chapter contains also an account of laboratory experiments to determine the "filtration resistance" of Thames water before and after storage. The apparatus is described, as also a special centrifuge for securing samples of the solids from the water and the method employed to obtain photomicrographs of the water content. A number of these views are reproduced. Finally, this chapter deals with changes in the quantity of Thames water due to storage—a subject in which Dr. Houston has long specialized. These general subjects are further considered in the third chapter, together with the treatment of algal infected water, the effect of filtration, and water and disease. The final chapter treats disinfection with excess lime, hypochlorite and liquid chlorine. Renewed attention may be called to that fact that hypochlorite disinfection was practiced under Dr. Houston on the water-supply of Lincoln, England, a city of about 50,000 population, from 1905 to 1911, thus anticipating the American practice by three years.

By way of minor criticism, it may be noted that the many useful diagrams in the book would have been improved by the use of abscissas and ordinates; that the typhoid statistics for American cities appear to be very much out of date (no dates given), and therefore unfair, and that the author's data on liquid chlorine also seem behind the times and meager. It should be remembered, however, that the original lectures were delivered more than a year ago and that it takes time for American data to become available in Englnad.

The book deserves the careful attention of all American engineers, chemists and bacteriologists having to do with surface water-supplies. Even the data which have little or no direct application in this country have large possibilities of suggestion and inspiration for all who approach their work in a scientific spirit.

Organic Structural Materials

WOOD AND OTHER ORGANIC STRUCTURAL MATERIALS: By Charles Henry Snow, C. E., Sc. D., Dean of the School of Applied Science, New York University, M. Am. Soc. C. E. New York: McGraw-Hill Book Co., Inc. London: Hill Publishing Co., Ltd. Cloth; 6 x 9 in.; pp. 478; illustrated. $5.

Wood as a structural material has had pretty thorough treatment in books written for the use of engineers; other organic materials commonly used in structures have not. The value of Professor Snow's book must then lie in the completeness or novelty in the treatment of the chapters on timber, and the engineering angle from which the discussions on oils, paints, varnishes, adhesives and rubber are viewed. In both of these respects the book may be said to be successful.

There is little new in the information on wood, but the arrangement of that information is admirable. Preliminary chapters on botanical classifications, physiology of trees, practical forestry, etc., are followed by specific pages describing the principal species of wood. These descriptions are in identical form, and include the nomenclature, localities, features of trees, color, grain or appearance of wood, structural qualities, representative uses, and physical properties of the woods. These tabulations are complete and informing. The information contained in them is most valuable to the engineer.

Succeeding chapters on wood take up specific physical properties and conditions affecting use and wear and are followed by a not altogether necessary chapter on fire protection. This ends the specific chapters on wood, though there is next a fairly complete exposition of wood-treating methods. The last part of the book, on the other organic structural materials, is novel and the engineering requirements of paints, oils, varnishes, glues and rubbers are adequately treated. As a whole the book is a definite and explicit reference and text.

Horizontal Tank Gaging Tables

HORIZONTAL CYLINDRICAL TANK GAUGING: Ratio or Percentage Method for Finding the Capacities of Cylinders at Any Level When in a Horizontal Position and for Finding the Areas of Circular Segments. Formulated especially for Horizontal Cylindrical Tanks with either flat or bulged heads such as are used for the transportation and storage of liquids. The Method Is Applicable to Cylinders of any Diameter.—By J. B. Morrow. Oakland, Calif.: S. O. Spencer [Lock Box 507]. Leather; 4 x 7 in.; pp. 68; illustrated. $10; foreign, $10.50.

Engineers in charge of road maintenance, repair and construction, and operators of asphalt plants and other industries purchasing liquids in tank-car lots, or persons who must compute the capacities of horizontal tanks, will find this book of more than incidental value in their day-to-day work. In a convenient form it presents rules, tables, and explanations by use of which anyone can compute and tabulate the contents of such tanks with a minimum of effort. As far as can be learned, this is the first comprehensive treatise on this problem.

The method of handling the problem is unique, and the accuracy obtained is well within the demands of such work. Only one basic table is needed for the computations, and from it can be determined the contents of a cylindrical tank of any diameter. Directions are also given by which the effect of bulged heads on capacity can be allowed for.

The method itself is based on the fact that the ratio between the area of a circular segment and the area of half a circle, of which the segment is a part, depends not upon the size of the circle but simply upon the ratio between the depth of the segment and the radius of the circle. While not of wide general interest, the problem of calculating the contents of horizontal cylinders is ordinarly so difficult of solution by usual methods that the book will no doubt find a place on the desks of many engineers.

Thirtieth Anniversary Number

The "Michigan Technic" (University of Michigan, Ann Arbor) featured its thirtieth anniversary in its December issue. Among other articles it contained one by J. H. Darling, a retired engineer of Duluth, Minn., on his private astronomical observatory, built

after his own designs, with the coöperation of an architect who is also an amateur astronomer. Another feature of "The Technic" was a spirited poem on "The Engineer," by Theodore A. Leisen—presumably Major Leisen, now in charge of utilities at Camp Custer.

Labor Unions Differ as to Functions

TRADE UNIONISM IN THE UNITED STATES—By Robert Franklin Hoxie, Ph.D., One Time Associate Professor of Political Economy, University of Chicago, Author of "Scientific Management and Labor," with an Introduction by E. H. Downey, Ph.D., Special Deputy of the Insurance Commission of Pennsylvania in Charge of Workmen's Compensation Insurance, late Chief Statistician of the Industrial Commission of Wisconsin. New York and London: D. Appleton & Co. Cloth; 5 x 8 in.; pp. 426. $2.50.

As the first student of trade unionism who perceived that, besides varying in type as to organization or structure, labor groups have functional differences through which a clearer understanding of the phenomenon might be secured, the late Prof. Hoxie occupies a unique position in his particular "guild." While the distinction he established may at first seem unessential, a close study of the application of the theory, as made in his posthumous volume, inevitably clears thinking and results in a saner attitude toward the problem.

The volume has been arranged from a series of lectures prepared for the classes in trade unionism at the University of Chicago. The students themselves made many researches under Prof. Hoxie's direction—for his method was thoroughly scientific and of the laboratory. As the basis of his own thinking and writing, he made himself familiar with conditions and tendencies not only through observing the manifestations of union activity, but by close study of the psychologic types of union organizers and of the actual conditions which lay behind their convictions. This intensity of research was unquestionably responsible for the discovery that unionism has its conservatives, its radicals, its nihilists, its altruists, and its materialists—that there is no entity such as "unionism" which can be covered by a phrase and dealt with as a single phenomenon—that the spectacle of working men uniting must be considered as many and diverse activities, the results of many and diverse causes.

And the causes? What of them? In general they cannot be traced back to the old guilds and crafts of the eighteenth century, but to conditions which were brought about by the introduction of machinery into a society organized in accordance with a highly individualistic philosophy.

Kutter's Formula Velocity Tables

TABLES OF VELOCITY OF WATER IN OPEN CHANNELS DERIVED FROM KUTTER'S FORMULA—By Arthur Alvord Stiles, State Reclamation Engineer. Bulletin 6, August, 1917. Austin, Tex.: State Reclamation Department. Paper; 6 x 9 in.; pp. 130. Free on application.

Velocities in feet per second to the nearest first and second place decimals are given for 30 different hydraulic slopes, for hydraulic radii from 0.2 to 50 ft., for n from 0.006 to 0.08. To aid in selecting from the 12 values of n suggestive notes are given. Eight of the 25 main tables were copied and extended from the "Hydraulic and Excavation Tables," issued by the U. S. Reclamation Service. The computations for the present tables were made by James P. Murray and John B. Upchurch, technical assistants to Mr. Stiles. The twenty-sixth table gives the velocity equations used in the computations, in order that those who so desire may verify the tabular velocities given or compute others, for values of n not given in the tables.

PUBLICATIONS RECEIVED

[So far as possible the name of each publisher of books or pamphlets listed in these columns is given in each entry. If the book or pamphlet is for sale and the price is known by the editor, the price is stated in each entry. Where no price is given it does not necessarily follow that the book or pamphlet can be obtained without cost. Many, but not all, of the pamphlets, however, can be secured without cost, at least by inclosing postage. Persons who are in doubt as to the means to be pursued to obtain copies of the publications listed in these columns should apply for information to the stated publisher, or in case of books or papers privately printed, then to the author or other person indicated in the notice.]

BUILDING STONES AND CLAYS: A Handbook for Architects and Engineers—By Charles H. Richardson, Ph.D., Professor of Mineralogy, Syracuse University, Syracuse. New York: The University Book Store. Cloth; 6 x 9 in.; pp. 422; 313 illustrations. $5.50.

BULLETIN OF THE SOCIETY FOR STREET CLEANING AND REFUSE DISPOSAL OF THE UNITED STATES AND CANADA. New York City: The Secretary, Jos. R. Buchanan, Municipal Building. Paper; 6 x 9 in.; pp. 22.

Issued in lieu of the Annual Convention, which, by vote of the Executive Committee of the Society, was abandoned because of the disturbed conditions due to the war.

DISASTERS AND THE AMERICAN RED CROSS IN DISASTER RELIEF—By J. Byron Deacon, General Secretary, Philadelphia Society for Organizing Charity (on Leave of Absence), Division Director of Civilian Relief for Pennsylvania. New York: Russell Sage Foundation. 5 x 8 in.; pp. 230. 75 cents.

FINAL REPORT OF THE INTERNATIONAL JOINT COMMISSION ON THE LAKE OF THE WOODS REFERENCE—Whitehead Kluttz, secretary for United States, Washington, D. C. Lawrence J. Burpee, secretary for Canada, Ottawa, Ont. Cloth; 7 x 10 in.; pp. 261; illustrated.

Physical facts and data on which are based the conclusions that the Lake of the Woods can and should be maintained at a relatively uniform level throughout all ordinary seasons and that the regulation should be under the control of the commission. The necessary regulation works and flowage damages would cost only a few hundred thousand dollars.

INTERCEPTING SEWER CONSTRUCTION IN THE NORTHERN PART OF THE SANITARY DISTRICT OF CHICAGO: Methods of Work and Cost Data—By H. R. Abbott, M. W. S. E., Assistant Engineer, Sanitary District of Chicago. Reprint from Journal of the Western Society of Engineers, June, 1917. Paper; 6 x 9 in.; pp. 33; illustrated. Free on application to Blaw-Knox Co., Pittsburgh, Penn.

A detailed description of 18 miles of sewer construction.

AN INTRODUCTION TO THE STUDY OF LANDSCAPE DESIGN—Henry Vincent Hubbard, Assistant Professor of Landscape Architecture, Harvard University. Theodora Kimball, Librarian, School of Landscape Architecture, Harvard University. New York: The Macmillan Co. Cloth; 9 x 12 in.; pp. 406; illustrated. $6.

IRON AND STEEL: Census of Manufactures, 1914: Including the Blast-Furnace, Steel-Works and Rolling-Mill, Wire, and Tinplate and Terneplate Industries—Prepared under the supervision of W. M. Steuart, Chief Statistician for Manufactures. Washington, D. C.: Bureau of the Census. Paper; 9 x 12 in.; pp. 68.

METER RATES FOR WATER-WORKS—By Allen Hazen, S. D., M. Am. Soc. C. E. New York: John Wiley & Sons, Inc. London: Chapman & Hall, Ltd. Cloth; 6 x 9 in.; pp. 217; illustrated. $2.25.

THE NATURAL STYLE IN LANDSCAPE GARDENING—By Frank A. Waugh. Boston: Richard G. Badger. Toronto: The Copp Clark Co., Ltd. Cloth; 6 x 9 in.; pp. 145; illustrated. $2.50 net.

OUTDOOR THEATERS: The Design, Construction and Use of Open-Air Auditoriums—By Frank A. Waugh. Boston: Richard G. Badger. Toronto: The Copp Clark Co., Ltd. Cloth; 6 x 9 in.; pp. 145; illustrated. $2.50 net.

SNOW REMOVAL IN THE CITY OF ROCHESTER, N. Y.—Report to Mayor by Rochester Bureau of Municipal Research, Inc. Paper; 6 x 9 in.; pp. 44.

THE STRENGTH OF STRUCTURAL ELEMENTS: A Textbook for Students, Engineers and Architects—By Ernest H. Sprague, A. M. Inst. C. E. With Examples. London: Scott, Greenwood & Son. [New York: D. Van Nostrand Co.] Cloth; 4 x 7 in.; pp. 196; 117 illustrations. 4 shillings net. American price, $1.75 net.

A pocket-size book suitable for elementary instruction of engineering students. Riveted joints, roof-trusses, beams, plate-girders and columns are covered in the main part of the book, followed by chapters on the three-movement theorem and oblique flexure. The treatment follows foreign practice. Theory being considered to the exclusion of experimental knowledge, the section on columns does little more than tell how to use formulas of the Rankine and straight-line types in design.

UNION SCALE OF WAGES AND HOURS OF LABOR, MAY 15, 1916—Washington, D. C.: Bureau of Labor Statistics. Paper; 6 x 9 in.; pp. 291.

UNITED STATES GEOLOGICAL SURVEY: Annual Report 1916-1917—Washington, D. C.: The Survey. Paper; 6 x 9 in.; pp. 176; folding maps.

LETTERS TO THE EDITOR

Comment on Matters of Interest to Engineers and Contractors Will Be Welcome

Should Engineering Students Be Drafted?

Sir—I have read, in your issue of Dec. 27, 1917, p. 1211, the letter of the fighting MacIsaac. Fortunately the committees of the great engineering societies and one of the faculties of the great engineering schools, who have been considered in this matter, agree that the best interests of the country will be conserved if we are allowed to continue to produce an article valuable in the proper conduct of the war both from a military and a civil point of view. Any one receiving as many letters as I from the various government war departments, as well as from civil organizations, asking for young engineers who cannot possibly be supplied, would certainly appreciate their value and understand what the stoppage of production would mean in coming years.

I would have less confidence in the result of our efforts in the war if, as Mr. MacIsaac says, those students who have not volunteered "would be useless if drafted," since this would equally apply to all others who are to be drafted to form our great army.

PALMER C. RICKETTS,
President, Rensselaer Polytechnic Institute.
Troy, N. Y.

Rapid Topographic Surveys

Sir—I have read with interest the various items appearing in *Engineering News-Record* with reference to topographic surveying and mapping that has been accomplished with a small outlay. The following will possibly be of interest to the "speed fiends." In 1916 this office made a topographic survey of this city and surrounding territory, embracing in all an area of 6200 acres. Careful control, adjusted by stellar observations, and adjusted level circuits were carried over the entire area, and the topographic features were mapped in the field with plane table. The contour interval of the field sheets was one foot. Each field sheet as completed was traced with 5-ft. contours, and a number of individual elevations were shown.

The entire work, including field and office work, key map, etc., cost the sum of $578.60, or an average cost of 9.3c. per acre.

The work was performed by the writer, assisted by W. F. Hicks, assistant topographer, U. S. Geological Survey, and two laborers.

A. D. DUCK,
Greenville, Texas. City Engineer.

Remedy for Alleged Confusion Due to Use of the Term "Mass"

Sir—Textbooks, tables and government documents tell us that it is more precise to speak of the "mass" of a pound than of the "weight" of a pound. Hence pounds, grams, kilograms, are well-recognized units of mass; in fact, in some textbooks they are given as the *only* units of mass used in engineering practice. Yet when we use formulas such as $\frac{1}{2}mv^2$ for the energy in a moving body we are told that, notwithstanding the fact that pounds, grams and kilograms are true units of mass, and that a pound of mass weighs a pound, etc., we cannot substitute for the m its value in those units, but must instead insert w/g, the weight (therefore also the mass in those units) divided by gravity. This naturally confuses the student or the engineer who likes to understand what he is doing and why, especially as he was given to understand that a pound of mass weighs a pound, from which he naturally understands that (barring the variation of gravity) the number of pounds of mass equals the number of pounds of weight.

To add still further to the confusion we are informed in well-known textbooks that this quantity w/g "has no unit," that it is not a physical quantity at all but merely a "ratio" or numeral (which is incorrect), hence not a mass at all, even though the formula calls for the mass. Also that "the number of units of mass in a body $= w/g =$ constant," yet this "constant" is different in each problem. Also that when 2 lb., therefore a mass of 2 lb., drops 3 ft. it represents 6 ft.-lb. of energy, in which very common case the number of pounds must *not* be divided by g to give the correct result.

In attempting to clear up this confusion it has been proposed to create a lot of new units, such as slug, geepound, engineer's unit of mass, metric slug, gryne, matt, metrog, etc., making the confusion still worse, with the result that the student and the careful engineer hesitate to use that useful quantity "mass" in their calculations.

All this confusion and all these confusing new units are quite unnecessary and could be entirely avoided if textbook writers would always state not only what units the letters in a formula stand for, but also in what units the resulting answer will be. In the common formula $\frac{1}{2}mv^2$ it is quite proper to substitute the mass in pounds as one naturally would do, and the answer will be quite correct, but the answer will necessarily be in terms of the less familiar though well-established unit "foot-poundals," which may then be readily reduced to the more usual unit "foot-pounds" by dividing by $g = 32.172$. Hence by simply shifting the division by g from one side to the other, confusion is cleared up, because the regular mass units, pounds, grams and kilograms, can then be used, and every student understands that if his final result is not in terms of the units he wants, he has to multiply or divide it by a conversion factor, which in this case is g. All these many proposed and confusing units of mass and pages of explanations (including some quite incorrect statements) are therefore entirely unnecessary, and the student need not hesitate to use the ordinary, well-known units of mass, pounds, grams and kilograms, for the m in these formulas.

The original cause of the confusion is that these units are sometimes (and quite properly) used to represent masses and sometimes forces. In the well-known unit of energy, foot-pounds, the pounds represent pounds of force, the derivational formula being force $\times$ distance $=$ energy. But in the formulas like $\frac{1}{2}mv^2$ the pounds represent pounds of mass, the derivational formula being mass $\times$ velocity^2 $=$ energy, and, as the force which acting on a pound of mass for one second and giving it a velocity of one foot per second is a *poundal*

(which is a pound of force divided by g), the energy must necessarily be in foot-poundals.

In its simplest form (though then lacking the derivational features) this useful formula can best be stated:

$mv^2 \times 0.0005099$ = gram-centimeters, when m is in grams (of weight or mass) and v is in centimeters per second.

$mv^2 \times 0.01554$ = foot-pounds, when m is in pounds (of weight or mass) and v is in feet per second.

$mv^2 \times 0.05099$ = kilogram-meters, when m is in kilograms (of weight or mass) and v is in meters per second.

These of course are based on the standard value for gravity; in the very rare cases in which the variation of gravity must be considered, the less simple formulas must be used.

It may be added here than when the masses are expressed in kilograms and the velocities in meters per second, in this formula $\frac{1}{2}mv^2$, the numerical results will be the energy in joules, volt-coulombs, or watt-seconds, which is an interesting illustration of the simple unity-relation which exists between the mechanical metric and these so-called electric units (which are in fact mechanical also). CARL HERING.

Philadelphia.

Coördination of Engineering Work in New York City

Sir—Referring to the timely editorial on "Uncoördinated State Engineering Sets a Problem," in your issue of Dec. 27, let me give a couple of incidents where coördination has been very effective.

Consolidation of the city of New York in 1898 brought in a heterogeneous lot of engineers, but with few exceptions little real combining followed. In 1902, however, the President of Richmond Borough gave to the Commissioner of Public Works practically a free hand for rearrangement. One central engineering bureau was established covering work of investigation, design, construction, and some maintenance, for sewers, highways, public buildings, topographical survey, retaining walls, bridges, refuse-disposal plants, street cleaning, street-railroad supervision, grade-crossing elimination, subsurface structure mapping, etc. A centralized filing bureau was established for all maps, plans and data. Two main divisions were organized, entitled "topographic" and "construction." Specialists were put in charge of each phase of work, but were assignable as needed to other work than their own, upon request from any bureau head, for special service. All the work came under the final "say" of the Engineer-Commissioner.

The method turned out well as concerns the work of the corps of about 250 engineers, and tended also to be helpful to the men themselves, at least the brighter ones, in giving them a varied range of experience rather than holding them to a single line of work for all time.

In 1910 there were organized two informal boards covering the city as a whole. One, composed of the chief engineer of the Board of Estimate and Apportionment and the consulting engineer of each of the five boroughs, met on the afternoons following Board of Estimate meetings, and discussed countless matters pertaining to engineering work of importance to the whole city: unifying specifications, plans, ordinances, forms of procedure, etc., and investigating many matters referred by the Board of Estimate. If something was to come up involving bridges, the chief engineer of that department was invited in, and so with other departments, as water, docks, etc. This consulting body had no final authority, but its suggestions carried weight and produced some very valuable results.

The second board, called the New York Sewer Plan Commission, had the same personnel as the first, but dealt specifically with sewer questions. It worked more directly through the borough president's sewer bureaus, and its function was to look to scientific testing, standards of design and harbor purification.

Only three states exceed New York City's population, and none have more intensive development, so that the methods carried out thus successfully here might well work out to advantage elsewhere. Coördinated direction and centralized final authority, with decentralized work carrying definite responsibility, is the key to public works success. LOUIS L. TRIBUS.

New York.

The Engineer's Interest in Foreign Trade

Sir—In your issue of Oct. 25, 1917, there appeared an editorial entitled "The Engineer's Interest in Foreign Trade." There were two very serious errors in regard to that editorial. In the first place the editorial should have been printed throughout in the same type used in the heading, and in the second place you should have placed the article on the front cover of your journal. Otherwise you are to be congratulated.

Perhaps, in view of the fact that we are at war and have a serious work on hand, your readers may think that the writer is laying needless stress on our foreign trade interests at this moment. Therefore he wishes to say that in making the foregoing remarks he is fully cognizant that we are at war. We must and will win the war, but because we are going to be the deciding factor in this struggle, the end will find the position of the United States one of prominence in the world; and if we cannot, when peace is declared, live up to the reputation we are gaining now, much of our efforts and energy will have been wasted. Heretofore American capital has been content to play the part of the cat, chasing its tail within the territory of the United States, and, because we never really did anything abroad, our reputation for ability to develop and finance world affairs was not what many Americans supposed it was. The time has come now when both our Government and our people must widen their horizon of vision and it is to be hoped that you will follow up your editorial with more of like trend.

As the writer has said before in your columns, the American public is entirely too apathetic toward the amount of development which must be carried out in various parts of the world, and the people of Europe are much more wide awake in this respect.

American engineers who have practiced their professions abroad should lend their help toward informing the public of the true state of affairs, because engineers are preëminently in a position to speak with

authority on conditions existing in countries where there is an opportunity and need for development. In comparison with other classes of people they are in a very advantageous position to gather facts, because their work brings them into close contact with actual conditions for extended periods, which advantage is hardly enjoyed by the mere tourist or business man.

Even Government employees do not get as close to things as may be supposed. As an example, the writer has before him a clipping from an American official report concerning a certain contract for a public utility, with the request that he investigate this matter. It happens that the contracts were closed and the work initiated over fifteen months ago.

The last paragraph of your editorial is especially worthy of note; it is in these points that we are as a whole very much lacking.

The importance of the use of the metric system in engineering work abroad cannot be overestimated, and yet only a few months ago the writer was astounded to note in an American magazine of high standing an article entitled, "The Metric System Myth." The magazine purported to have extracted the article from the *American Machinist*, and stated that the editor of the latter journal had declared that the metric system was not in general use in France.

Perhaps the authority given for the article was wrong, but the metric system is in use in France, very much so, and also in practically every other country in the world except the British Empire and the United States, and even Great Britain is now using the metric system in foreign trade. Even British and American standards are in many cases identical in name only.

If the American manufacturer or contractor wishes to go abroad, the sooner he adopts the metric system the better, and there are no unsurmountable obstacles in the way. Certainly it is as easy to state weights in kilograms, volumes in liters or cubic meters, and measurements in meters, centimeters and millimeters as it is to state them in the English system; and when we talk in the metric system we are talking in a fairly universal language. It is well understood that dimensions of parts of existing standards of fine machinery can sometimes not be stated conveniently in millimeters, but the measurements of such parts are hardly of importance except to the manufacturers, and in the shops they are usually gaged and not measured. But when we talk of the dimensions of bridges, buildings, railways, land, semi-finished material and the commodities of trade and engineering in general in units that no one but ourselves use, we are hurting ourselves.

Sometimes American manufacturers do prepare catalogs in the metric system, but when they have to state, say, wire diameters or sheet-metal thicknesses, they still use arbitrary gages, and sometimes do not even state what gage they are using. As there are about seventeen systems in use, how is a foreigner not trained in American shops and offices to know what is meant? Millimeters are universal. If any one doubts the utility of the metric system let him give it a fair trial in his calculations for a few days. At first a little difficulty will be experienced in forming mental conceptions of the quantities, but engineers and constructors work by scientific calculations, and not by rule of thumb. All units in electrical engineering are based on the c. g. s. system, and there is no reason why mechanical and civil engineers cannot speak and calculate in the same terms.

Even that monetary monstrosity—the English system of coinage—could easily be transformed into a decimal system by calling a half sovereign the unit, whereby we would get ten shillings to the unit. Ten pence could be equal to one shilling, and the only change in coinage would be marking a sixpence as five pence. For a short period sellers would probably be given slightly greater values for sales under a shilling, but this might be of some advantage to the people who need it most.

When it comes to figuring foreign exchange, no matter what system of coinage a particular country has, all sorts of erratic ratios will occur between the standard units of different countries, and such ratios will be constantly varying—a point that Americans must grasp. Persons not accustomed to the phenomena of international exchange are surprised when told that a dollar has not a fixed value in terms of the money of other countries, but this is quite true, and a realization of this fact is very necessary to an engineer interested in foreign work, especially if he has to deal in matters regarding finance.

Suppose, for example, he is operating a public-service concern in a South American country where his receipts and local disbursements are in the units of the country where he is operating. If he works out his reports in the units of another country he is likely to get all manner of surprising results and comparisons for consecutive financial periods. Therefore he has to know the meaning of exchange and be able to take into account its effects on his operations.

There are all sorts of other matters of importance that an engineer must grasp if working abroad, and your editorial broadly indicated this when it spoke of the "systematic education of a good portion of the rising business generation in the numerous new subjects which must be mastered for the successful development of foreign trade," and the main reason the writer has for presenting the foregoing is to keep this subject alive and provoke intelligent questions and communications.

By all means let us have as much light as possible on this important phase of our national development.

Rio de Janeiro, Brazil. CHARLES J. SEIBERT.

[The clash in statements by Mr. Seibert and the *American Machinist* is more apparent than real. The journal in question stated that the metric system is not in general use in France, while Mr. Seibert says it is much in use. Both seem to be correct. The attitude of the *American Machinist*, its editor states, is that while there is no objection whatever to volunteer adoption by manufacturers of the metric system, the advantages of the system are not great enough to warrant the expense and confusion that its compulsory adoption would cause.—Editor.]

Inch-Foot Water Charge Proposed

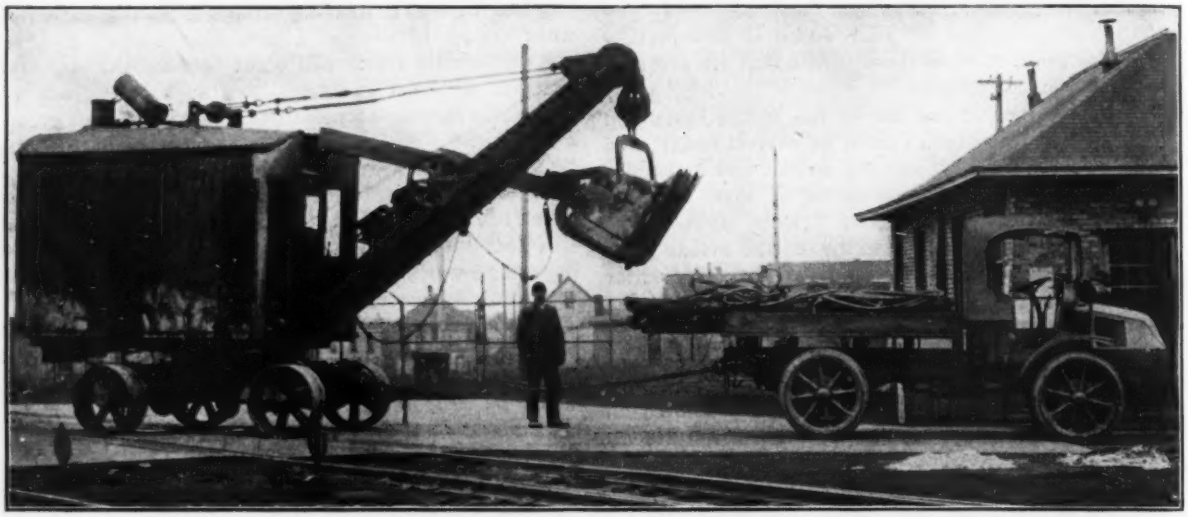
An annual charge of 0.6c. per inch diameter for each foot of water mains is proposed in a schedule of rates submitted by the Commonwealth Water Co. to the New Jersey Public Utilities Commission for approval. The company supplies water in Summit, West Orange and five other communities.

HINTS FOR THE CONTRACTOR

DETAILS WHICH SAVE TIME AND LABOR ON CONSTRUCTION WORK

Milwaukee Contractor Hauls Shovel About Town at 8 Miles an Hour

ARTHUR MANGER, excavating contractor of Milwaukee, does not believe in wasting the time required for his revolving shovels to navigate the city streets from job to job unaided. At least, the ¾-yd. shovel shown in the photograph, which weighs about 18 tons, did not travel in that way. The shovel is shown in tow of a Walter tractor on a 5-mile trip which it recently made at the rate of eight miles an hour. On this journey it was hauled up a 3½% grade without difficulty.



MOTOR TRUCK HAULS 18-TON REVOLVING SHOVEL THROUGH CITY STREETS FOR FIVE MILES AT GOOD SPEED

Men and Hoist Pull Off Concrete Pile Tops After Reinforcing Is Cut

SOME precast concrete piles in one of the navy yards were driven to refusal while their tops were still above proper grade. The method of cutting them off is described by Civil Engineer Kirby Smith, of the United States Navy, in Bulletin 28 of the Public Works of the Navy. The piles were 18 in. square at cutoff, reinforced with eight ¾-in. square rods tied together with ⅜-in. wire hoops 2 in. c. to c. for a distance of 3 ft. from each end and 8 in. c. to c. between these limits. They were driven 3 to 20 ft. above the required elevation, the difference being due to a varying stratum of rock. Outside the reinforcing rods there was a protective concrete covering of 2 to 2½ in. This was chipped off at the required level with a cold chisel and a sledge, leaving the rods exposed. An air drill was tried, but the chisel-and-sledge method was found to be easier. Then the rods were cut with an acetylene torch. This left the concrete core, which had a low tensile strength. Where the projecting pile was of sufficient length to give good leverage, a 1½-in. manila rope was slung around the top and four men pulling on the rope snapped the pile off at the cut. Where the projecting portion was short, the same result was accomplished by a direct pull from a stationary engine and a ⅞-in. steel cable attached to the top of the pile. Two men were employed in cutting out the concrete, and four men to snap off the piles. The average time for each pile was one hour, and the total cost per pile averaged 60 cents.

Mixture of Asbestos and Cylinder Oil Useful in Babbitting

BY LOUIS A. M. BUSHNELL
Oak Ridge, N. J.

THE writer has found that where there is much babbitting to do fire clay can be replaced conveniently by a mixture of asbestos and cylinder oil. The asbestos and oil should be mixed to a plastic state, and can be used a good many times.

Wreck Brick Building in One Day with Dynamite and Save the Brick

BY HARRY GOUGH
St. Mary's County, Maryland

Twelve dollars, in addition to labor, covered the entire cost of wrecking a three-story 30 x 40-ft. brick building, the interior of which had been destroyed by fire. Two men did the entire job in one day. The walls were 2 ft. thick except at the corners, where they joined two brick chimneys. There the thickness increased to 5 feet.

It was desired to salvage the brick, yet scarcity of labor made wrecking by hand prohibitive. The writer

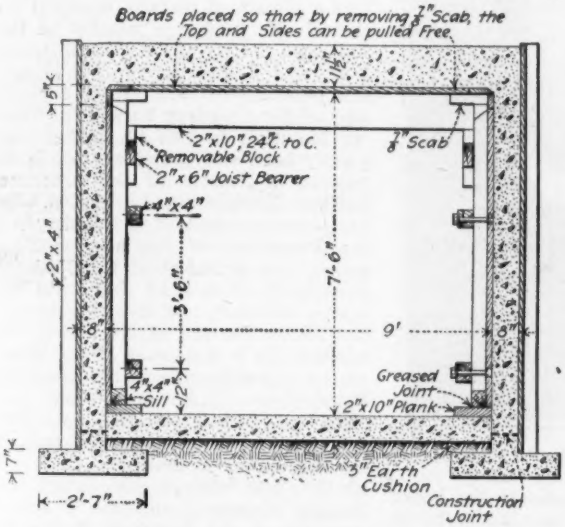
had holes 6 to 8 in. in diameter picked half way through the base of the walls at intervals of 6 ft. They were then loaded with three sticks 1¼ lb. of 30% dynamite in each hole along the walls, and five sticks at the chimneys. One wall was shot at a time, using a battery. Most of the bricks, except those close to the blast holes, were unbroken and fit for further use after they had been cleaned.

It took 55 lb. of dynamite and 35 caps to clean up the entire job.

Place Floor of Tunnel First, Use Sliding Form for Walls and Roof

By Frank A. Baxter
Concrete Construction Co., Cincinnati, Ohio

SLIDING forms were found to effect a great saving in time and labor in the recent construction of a concrete tunnel for the Eastman Kodak Co. The tunnel, connecting the power house and a new building, is 810



FOOTINGS AND FLOOR PLACED FIRST, PARTLY COLLAPSED FORMS SLID ON GREASED JOINTS

ft. long and will be used to carry steam pipes and electric conduits.

The specifications called for a footing 31 in. wide under each wall, a 7-in. floor slab and a 3-in. earth cushion between the floor slab and the top of the footings. In order to get a firm base on which to slide the forms, and also to avoid mud and water, it was desirable to pour the floor slabs before the side walls. The footings and 5 in. of the walls were therefore concreted first. The 3-in. cushion was then placed and the floor slab poured. The sliding forms, shown in the drawing, were then set in place, the walls and roof slab being poured together.

The inside forms were built in three 16-ft. sections and were set on a 2 x 10-in. dressed plank runner well greased on top. On this plank the side panels bore directly. They were made up above ground, and consisted of a dressed 4 x 4-in. sill, 2 x 4-in. battens on 2-ft. centers, and ⅛-in. sheathing.

The roof slab was supported on 2 x 10-in. joists on 2-ft. centers, which rested on continuous 2 x 6-in. joist-bearers nailed to the side forms. Between each joist and the 2 x 6-in. bearer a 4-in. block was placed which could easily be knocked out, permitting the roof panels to drop 4 in. The joist and roof panels were made 8 in. shorter than the width of the tunnel, which permitted the side forms to be drawn in 4 in. on each side, and gave clearance enough for the forms to be slid along to their next position. The top corners were filled in with loose boards held in place by ⅞-in. scabs as shown on the drawing. These boards remained sticking to the concrete when the sides and roof were collapsed.

The wall forms could be pulled in by means of two 4 x 4-in. rangers bolted to each side. It was planned to use carpenter's bench clamps to draw in the sides, but these were not strong enough. A rope loop slipped around the 4 x 4's and twisted with a bar was very effective. The collapsed forms were moved forward by six men with a double tackle. Three 16-ft. sections, making 48 lin.ft. of tunnel, were placed and concreted at a time. The three sections could be collapsed, moved forward and reërected within two days by six carpenters.

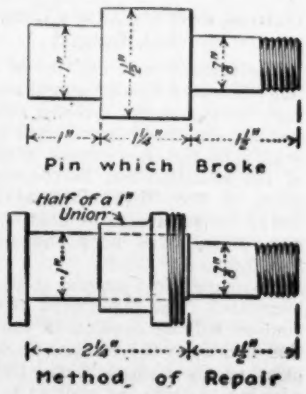
The exterior wall forms were built and placed with panels 20 in. wide, tacked to 2 x 4-in. battens 2 ft. apart, and wired every 20 in. The tunnel was designed by the Eastman Kodak Co. and built by the Ferro-Concrete Construction Co. The forms were designed and built by Stacey Campbell, superintendent of the work, O. E. Brown, carpenter foreman and the writer, form designer for the contractors.

Repair Pin of Steam Shovel Engine with Half of Pipe Union

By Louis A. M. Bushnell
Oak Ridge, N. J.

THE pin which holds the link motion of the valve stem blade on a Marion Model 31 steam shovel, engaged on dam construction for the City of Newark, near Oak Ridge, N. J., was recently replaced, after it had broken, with a pin made of a 1-in. bolt and half of a pipe union.

When the part broke, there was no spare pin to replace it on the job, and no machine shop was near. Ten days would have to elapse before a new pin could come from Ohio, and it was very important to keep the steam shovel running. The writer took a 1-in. bolt and drew the end down to ⅞ in. diameter, putting a thread on the small end. Half of a brass union was then filed to fit on, as shown in the sketch.



ONE-INCH BOLT AND PIPE FITTING MAKE NEW PIN

The steam shovel was running within an hour after the original pin broke, and the substitute pin gave good service for three weeks.

NEWS OF THE WEEK

CURRENT EVENTS IN THE CIVIL ENGINEERING AND CONTRACTING FIELDS

Government To Build Barges for Mississippi

Shipping Board Has Allotted Three Millions To Be Spent by Chief of Engineers

After some months of indecision the United States Shipping Board has finally allotted $3,360,000 for the construction of four towboats and 24 barges to be used in freight carriage on the Mississippi River. The operating program of the fleet has not been announced, but the board has turned the work of construction over to the chief of engineers of the army. It is proposed to ask bids for building the vessels in the customary manner. Plans and specifications are being made in the St. Louis office of the Engineer Department.

While full details of the boats cannot now be given, it can be said that the barges are about 300 ft. long and 48 ft. wide, and that they will carry 750 tons on a 4-ft. draft, and correspondingly greater amounts as greater depth of channel becomes available. Thus on a 6-ft. draft the barges will carry about 1800 tons and on 8 ft. about 2600 tons each. It is expected that each towing unit will consist of a towboat and three barges. The towboats will be of unusual power for the upper Mississippi, developing 1500 hp. on 3½-ft. draft and 2000 hp. on 4-ft. draft, the difference in draft being controlled by the amount of coal carried. These boats will be of stern-wheel type and will incorporate all of the most approved details in boilers and machinery.

Date of Foreign Trade Convention Is Changed

The Executive Committee of the National Foreign Trade Council announces that "owing to the railroad congestion and the desire of the Council to coöperate with the Government in the relief of the situation due to the war," the dates of the Fifth National Foreign Trade Convention to be held at Cincinnati, Ohio, have been changed from Feb. 7-9 to Apr. 18-20.

No change in plan and scope is contemplated. The three days of the convention will be devoted to the obligation laid upon the foreign trade enterprise of the United States to help in winning the war, as well as to discussion of the war-winning value of foreign trade in sustaining credit through the maintenance of the gold reserve, and in insuring supplies of necessary raw materials for war use. Consideration will also be given to the demands and problems of the renewed competition after the war.

A. N. Talbot Elected President of American Society

Prof. Arthur N. Talbot, of the University of Illinois, has been elected president of the American Society of Civil Engineers for the coming year.

Professor Talbot was born in Illinois Oct. 21, 1857. He was graduated from the civil engineering course of the University of Illinois in 1881. From 1881 to 1885 he was engaged in various railroad work in the West. In the latter years he returned to his alma mater to become a member of its faculty. In 1890 he was made professor of municipal and sanitary engineering and given charge of theoretical and applied mechanics, and he has held these posts ever since. Although he has thus remained 27 years in one place, his activities, both in the development of engineering education at the University of Illinois and in his outside work, have made him a prominent feature in engineering investigations.

ARTHUR NEWELL TALBOT

Under Professor Talbot's direction the University of Illinois developed systematic laboratory work in strength of materials as early as 1890, his efforts culminating in one of the best-equipped material-tesing laboratories in the country. Under his direction, too, have been made important studies of the properties of built-up iron and steel members, brick and terra cotta columns, timber, paving brick and reinforced concrete.

The hydraulic laboratory of the University of Illinois, also one of the best equipped of its kind in the country, is likewise in part his work. He has made a wide range of hydraulic investigations.

He has contributed much to the study of railroad problems. His book on "The Railway Transition Spiral" is one of the classics on that subject. The studies now being made by the joint committee of the American Society of Civil Engineers and the American Railway Engineering Association, of which he is chairman, bid fair to produce the first authoritative information ever obtained on the stresses in railway track.

In view of the wide range of investigations that Professor Talbot has followed, it is not strange that he has held a prominent place in technical societies. He became a member of the American Society of Civil Engineers in 1898, was a director in 1909-10 and vice president in 1911. He was president of the American Society for Testing Materials in 1913-14, having previously been vice president. He is at present a director of the American Railway Engineering Association. He has been president of the Society for the Promotion of Engineering Education, vice president of the National Association of Cement Users and executive secretary and then president of the Illinois Society of Engineers. In addition, he is a member of the Western Society of Engineers, the American Water-Works Association and the American Society of Municipal Improvements. He was vice chairman of the Committee on Reinforced Concrete of the International Association for Testing Materials, and was a representative of the American Society of Civil Engineers of the Joint Committeee on Concrete and Reinforced Concrete.

Opinions Conflict on Pending Water-Power Legislation

The House of Representatives on Jan. 11 adopted a resolution creating a special committee of 18 which is to handle all water-power legislation during the present Congress except bills over which the Committee on Foreign Affairs has jurisdiction.

To this latter committee has been referred a bill introduced on Jan. 9, empowering the President to take over all the water-power plants on the American side at Niagara Falls. The owners of the plants are to receive a "just and fair compensation for the use of their property," to be fixed by an impartial agency to be named by the President upon the basis of a reasonable profit in time of peace. The President is also authorized to import from Canada the maximum horsepower per-

mitted under existing treaties and to open negotiations for a new treaty providing for increased diversion of water on the American side, "having due regard for the preservation of the scenic grandeur of Niagara Falls and of the rapids." The bill appropriates $20,000,000 as a revolving fund to pay for installations to increase the power and to meet any deficits that may be incurred in the operation of the plants.

While some opposition has been voiced in the House to the administration bill providing for the grant of licenses by the Government for the development of water-power projects, the prospects for its passage there after some amendment appear favorable.

In the Senate the prospect is uncertain. The Shields bill, which has already passed the Senate, is itself a compromise measure, and while it is understood that the Administration will endeavor to bring the Senate to the support of its measure, the harmonizing of conflicting opinions may prove impossible.

Highway Board Submits Plan for Terminal Relief

The Highways Transport Committee of the Council of National Defense presented to the Highway Traffic Association of New York its plan for the relief of the terminal congestion which is at present such a tremendous problem in Manhattan. The scheme as explained by Roy D. Chapin, chairman of the committee, at a meeting held at the Automobile Club, New York City, Jan. 15, involves a practical pooling of the trucking resources of the city in order to effect what is known as "store-door deliveries," through which individual consignees will surrender their privilege of having freight held in cars.

As outlined by Mr. Chapin, the regulations, if adopted, will result in the unloading of cars as soon as possible after their receipt at Manhattan piers or freight stations. This unloading will be done by railroad employees who will pile the freight according to delivery zones. While a merchant may use his own trucks to carry freight to the piers or stations, he may not place in them goods intended for more than one station. As soon as the truck is unloaded it virtually passes from the control of its owner, and cannot leave the pier or station until it is fully loaded with freight. This loading will be so arranged that trucks will make deliveries in only one zone, but perhaps to several merchants.

The committee announced that their plan was submitted in the hope of drawing the widest possible criticism. As it now stands it is proposed only as a remedy to be applied to the Borough of Manhattan, New York City. However, the committee pointed out that "store-door delivery" was at present the only plan under which freight could be shipped in Great Britain, and that its operation has demonstrated that its simplicity and expedition had more than outweighed the objections.

"Sense" of American Society Meeting Opposed to Revised Constitution

Discussion Headed Off by Resolution Calling for Letter Ballot—Final Reports of Two Committees Accepted

What was expected by some to be a spirited discussion of the proposed revised constitution of the American Society of Civil Engineers was forestalled yesterday, Jan. 16, at the 65th annual meeting of the society by a resolution referring the matter to the membership for letter ballot. Nelson P. Lewis, who opposed the changes, introduced the resolution; and embodied in it was a declaration that the "sense of the meeting" was opposed to the adoption of the revision. The resolution was passed without discussion. Thanks to the quick disposal of this matter, and the absence of new business, the meeting was adjourned in two hours and 15 minutes, despite the necessary injection into the proceedings of the president's address, and the half-hour consumed in the reading of the printed reports of the board of direction, secretary and treasurer. Two final reports, those of the committees on road materials and on steel columns and struts, were accepted with little discussion. Progress reports were received from the four other special committees.

Although 803 members were registered as having indicated their intention to be at the meeting, the actual attendance was considerably less than that of last year. A war service flag displayed showed 953 members of the society in service, but it was stated that the number is now nearly 1000.

The first business of the meeting was the address by the incoming president, George H. Pegram, extracts from which appear on page 116. As stated there, this address was delivered at this time because of the abandonment of the annual convention last June.

Report of Board of Direction

The annual report of the board of direction showed a net gain in membership of 398, as compared with 283 for the previous year. The total membership Jan. 1, 1918, was 8590.

During the year additional payments aggregating $208,500 have been made to the United Engineering Society, bringing the total cost of the share of this society on this account up to $262,500. To secure this money a mortgage debt of $150,000 has been incurred, the balance, $112,500, having been paid out of reserve and current funds.

War activities of the society mentioned in the report include the joint telegram signed by President Pegram and the presidents of the other founder societies Feb. 6, expressing to President Wilson the cordial unity in support of the administration of the combined membership of 30,000 engineers; the adoption Mar. 7 of resolutions commending the severing of diplomatic relations with Germany, and offering to the Government all of the service of which the members were severally and collectively capable; the adoption by the board Apr. 18 of resolutions urging Congress to pass a bill for universal military training; the aid extended by the membership in the recruiting of engineer regiments; and the offer of the old society house to the food administration. Among the other of the many activities of the year recounted in the report are, besides the moving of the society to its new quarters in the Engineering Societies Building and the formal welcome of Dec. 7, the formation of the Engineering Council and the appointment of Alfred D. Flinn, director of the American Society of Civil Engineers, as executive secretary of the United Engineering Society the Engineering Foundation and the Engineering Council.

Engineering Education

Desmond Fitzgerald, chairman of the special committee on engineering education, announced that while the committee could still report progress only, a full report, based on the findings of the Carnegie Foundation, would probably be issued this year. At his request Dr. C. R. Mann reviewed briefly what had been previously reported by the foundation and what lines the investigation had followed since the last report. He mentioned three elements in the average engineering problem—science, practice and cost. He held that most of the schools dealt with the first well, the second fairly so, but the third hardly at all—and yet the control of engineering work is largely in the hands of those who are concerned primarily with the cost. The forthcoming report will indicate how engineering education should be shaped to recognize the importance of this third element.

A 247-page progress report of the special committee on stresses in railroad track was presented by Prof. A. N. Talbot, chairman of the committee and incoming president of the society. Still further progress, stated Professor Talbot, has been made since Nov. 3, when the report was printed.

Brief progress reports of the soil and water-rights committees were presented.

Two Final Reports Accepted

A final report of the committee on materials for road construction was presented by George W. Tillson, in the absence of Lieut. Col. W. W. Crosby. Mr. Tillson pointed out that, while the report embodied many of the suggestions made at the various discussions of the progress reports, it could not accept them all, and was perhaps not even entirely in accord with the views of the individual members of the committee. He also contended that with road work in such an experimental

state, the report would necessarily soon be out of date. He asked, however, that it be accepted as final, and that the committee be discharged. It was so voted, the thanks of the society being tendered to the committee.

L. D. Rights, chairman of the special committee on steel columns and struts, presented a final report for that committee. Part of this, he pointed out, was a repetition of the matter previously brought forth in progress reports. Among the special features of the report, he called attention to a new term, the useful-limit point, adopted by the committee. He also stated that the committee had concluded that it would be useless to attempt to write a rational column formula, as such a formula would be subject to possible variations as great as 28%. He stated that the Bureau of Standards, which had conducted the tests for the committee, could make no more such tests until after the war. He asked, therefore, that the committee be discharged, believing that if it was desired to continue the investigations after the war a new committee could be created. The society voted to accept the report with thanks, and discharged the committee.

Letter Ballot on Revision of Constitution

When the revision of the constitution was called for discussion, Nelson P. Lewis took the floor. He stated that while there were reasons for desiring that the constitution be revised, there were objectionable features to the present plan. Many of the changes he regarded as trivial, and some of them as distinctly undesirable. One of the latter was the new definition of eligibility to the society, which seemed to restrict engineering to responsible charge of construction work. He thought that would exclude men who had rendered valuable service in research work. He also objected to the proposed plan for disciplining members. While admitting that the present machinery for this purpose was cumbersome, he felt that the matter should not be left wholly to the board of direction without the constitutional right of the accused to be heard. He thought also that the plan for the creation of a small executive committee was objectionable. While he believed it unlikely that such a committee would abuse its power, he felt that it should be made impossible for this to take place.

For this and other reasons, he proposed a resolution that the matter be referred to the membership for letter ballot, accompanied by a copy of the discussion and a statement that the "sense of the meeting" was opposed to the revised version. There was no discussion of his remarks or of other phases of the proposition, and the resolution passed with a relatively small number of dissenting votes.

Prizes were awarded during the year as follows: Normal Medal, to B. F. Groat, for his paper "Chemi-Hydrometry and Its Application to the Precise Testing of Hydro-Electric Generators"; J. James R. Croes Medal, to H. S. Prichard, for his paper on the effects of straining structural steel and wrought iron; Thomas Fitch Rowland Prize, to J. Vipond Davies, for his paper on the Astoria tunnel under the East River in New York City; James Laurie Prize, to H. R. Stanford, for his paper on the Pearl Harbor dry dock; Collingwood Prize for juniors, to C. E. Chase, for his paper on the Cherry Street bridge, Toledo, Ohio.

Officers for the coming year are elected as follows: President, Arthur N. Talbot; vice presidents, John F. Coleman and Nelson P. Lewis; treasurer, George W. Tillson; directors—District 1, George W. Goethals and A. M. Hunt; District 4, Samuel Tobias Wagner; District 9, E. E. Wall; District 10, Milo S. Ketchum; District 11, Harry Hawgood; members of the nominating committee—District 1, Charles E. Trout; District 2, Clarence Blakeslee; District 4, Robert Farnham; District 7, J. H. Darling; District 8, C. A. Morse; District 9, C. E. Johnston; District 12, Joseph Jacobs.

Secretary Houston Will Urge Vital Road Work

On Jan. 7 the American Association of Highway Officials, through its president, G. P. Coleman, Virginia state highway commissioner, sent to the Federal Government a set of resolutions requesting that it formulate and promulgate as soon as possible a definite policy to govern highway construction. On Jan. 11 reply of the Department of Agriculture was received by the association and proved to be most encouraging on many of the points upon which a decision was asked.

Secretary Houston said, in part: "So far as it is practicable to do so, this department will urge the maintenance of the roads already constructed; the construction and completion of those highways which are vitally important because of their bearing upon the war situation or for the movement of commodities; the postponement of all highway construction relatively less essential. . . . The department will do all in its power to place before the proper department all available information to aid in a practicable determination of the question of freight-car supply for the movement of road materials."

The resolutions of the American Association of Highway Officials were as follows:

Whereas, The proper construction and maintenance of the highways of the country is necessary to the successful conduct of the war; and

Whereas, The plans of all highway authorities in the country, all users of highways and all citizens interested in any way in highway construction and maintenance are at the present time upset and tied up; and

Whereas, There is need for a definite policy so that plans can be formulated for the coming year; and

Whereas, A properly outlined policy directing the construction and maintenance of such roads and streets as are of general economic and military value will conserve the resources of the country and will greatly facilitate the transportation of freight over highways and streets; therefore, be it

Resolved, That the American Association of State Highway Officials request the United States Government to formulate and promulgate, as soon as possible, a definite policy for road and street construction and maintenance, and

That it is requested that said policy contain a statement that freight cars shall be furnished next spring for the transportation of the necessary materials for the construction and maintenance of streets and roads of economic or military value.

Road Industries To Organize for Active Work

After conferring with the Office of Public Roads, the Highways Transport Committee and the executive committee of the American Association of State Highway Officials, the Highway Industries Association, which was tentatively formed in Detroit Dec. 28, will hold a final organization meeting in Chicago at the Auditorium Hotel, Jan. 21. At this meeting every facility and effort will be marshalled to the support of an economically sound program of highway construction and maintenance. This is in accord with the announced purpose of the association, which is as follows:

"The objects shall be to assist in coördinating the highways with the other transportation agencies of the country; to encourage the development of highways that will advance the economic life of the nation; to stimulate their use in such manner as to facilitate and cheapen the transportation of food, raw materials and finished products, and to coöperate with Government agencies, both state and national, to the end that our highways may be of maximum service in the transportation system of our country."

S. T. Henry, Colorado Building, Washington, D. C., is acting as secretary of the committee on organization.

Chicago Sanitary District Has New Plan

The trustees of the Chicago Sanitary District adopted Jan. 5 a plan under which they propose to contribute some $450,000 toward the construction by the Federal Government of submerged weirs in the Niagara and St. Clair Rivers, to raise the level of the water of the Great Lakes, provided the Government will discontinue its opposition to the withdrawal by the district of sufficient water to dilute the sewage of Chicago in its flow through the Drainage Canal to the Mississippi River.

Rapid-Transit Agreement Is Reached in Philadelphia

The Philadelphia Councils on Jan. 3 passed an ordinance carrying a 40-year contract with the Philadelphia Rapid Transit Co. for the operation of all surface and rapid-transit lines in the city. The Frankford elevated railway and all further rapid-transit lines are to be operated as soon as completed, and traffic exchange between these and the surface lines throughout the city is arranged. The agreement establishes complete community of interest between the city and the company. It provides for a board of supervisory engineers, three in number, to direct the planning, equipment and operation of the lines and to change the rates of fare whenever financial conditions require. This board will work under the approval of the State Public Utilities Commission.

Full guarantee of 5% earnings on the company's present capitalization of $30,000,000 is provided for, and dividend payments are strictly limited to this amount. Gross earnings are to be applied consecutively to operating expenses, taxes, fixed charges, rental to the city under the 1907 contract and a 5% dividend payment divided between city and company in the ratio of their capital interests. What is left over and above this amount is to be put into a surplus fund for covering the operations of less successful years. All payments have cumulative preference. The city may, however, at any time transfer part of the burden of fixed charges on its own investment to the taxpayer, thereby relieving the car rider. This is done by certification each year to the company by the city authorities of the amount of the city's capital interest which for the purposes of that year is to be taken into account.

Adjustment of the rate of fare is to be made by the board of supervisory engineers when the surplus becomes too large or too small. For the present, fares throughout the city are to be five cents with free transfers (abolishing the present three cents for tickets), except in the downtown district or "delivery zone," where the transfer tickets are retained. The company is to start operating the Frankford elevated railway as soon as completed, connecting it up with the Market St. subway.

The contract is to run for 40 years (to 1957), but there is provision for recapture of the entire system or part of the system by the city at any prior time. The contract still requires vote of the stockholders of the company to ratify it, but as it was drawn up in consultation between representatives of the city and the company it will probably be approved.

Scranton Puts City Engineer Under Civil Service

By a unanimous vote of the retiring City Council of Scranton, Penn., the office of city engineer of that city will hereafter be filled under civil service rules.

Abolishing Secrecy in Army Contracts

Indications in Washington Point to Change in Present Contracting Methods—Public Opinion Responsible

Secret buying of many classes of supplies for the army has been under fire in Washington for nearly a month, at hearings held by the Senate Committee on Military Affairs. Although the newspapers have reported some of the testimony, the importance of this investigation is little realized. There have been general complaints from manufacturers of construction machinery, building supplies, clothing and munitions, as well as from contractors, that they were given no opportunity to do business with the army, on account of its policy of secrecy, although there was no such difficulty in bidding on navy and marine corps supplies.

So long as only manufacturers grumbled, the public attributed the complaints to the chagrin of disappointed business men. But when thousands of young men sent to cantonments and camps wrote home that they had inadequate clothing, when it became known that there was an insufficient supply of certain classes of arms to enable the men to receive prompt training in their use, then the public took the matter in hand. During the recent recess of Congress, some of its members have been making personal investigations at camps and cantonments and others have been corresponding with men who know about the conditions of these young soldiers. And as a result, the Senate Committee on Military Affairs, which is one of the "strong" committees of Congress, has been trying to find out why the young soldiers have had to put up with deficient equipment and defective living conditions. Really, however, what is on trial before the committee is the system of secret contracting adopted by the Secretary of War at the instance of the Committee on Supplies of the Council of National Defense.

Reason for Present Policy

In the first annual report of the Council of National Defense, just made public, there is a detailed explanation of the reason for the adoption of this policy and the text of the order of the Secretary of War of Apr. 12, 1917, directing that contracts "for the supply and equipment of the army, for fortifications and other works of defense . . . will be made without resort to advertising for bids in the letting of the same." Further information concerning this order was given in the testimony of Charles Eisenman, of the Committee on Supplies, before the Senate Committee. He went to New York "to do a job" and found that news of what he was after had already reached the trade, so that he could not accomplish his purpose. He accordingly urged the adoption of a policy of partial secrecy concerning the work of his committee, so that while the trade would receive advance notice of the letting of contracts for the materials in which he was particularly interested it would not get enough information to enable combinations to be formed to advance the price of products or corner any market. This policy was adopted.

Under it, and by order of the Secretary of War, the committee designated what grades of supplies should be bought and who should get the contracts for them, the Quartermaster Corps merely drafting the form of contracts, signing them and inspecting the materials. Specifications for different classes of materials were prepared by the committee and submitted to manufacturers. In many cases the price which the Government would pay was fixed, and all the manufacturer could do was to agree to furnish a certain amount of goods of specified quality at a price fixed by the Committee on Supplies. Mr. Eisenman testified under oath that this policy saved the Government large sums, furnished supplies of good quality as rapidly as needed, and that shortages which might exist at camps were due to other causes than the system of buying without public advertising. A large amount of testimony was introduced to the effect that this system prevented the early delivery to the Government of supplies it needed, failed to utilize the manufacturing capacity of the country, caused a deterioration in quality of certain supplies, and did not, in fact, furnish supplies as promptly as claimed by Mr. Eisenman nor as promptly as was the case with the Navy Department.

At this writing the Senate Committee has not finished its hearings and its official report will probably not be ready for some time. But some members of the committee have already introduced bills which, if passed, will radically change the present system of purchasing army supplies. Consequently the time has come at last when there can be no objection to a public discussion of a policy which has caused great dissatisfaction among leading producers of army supplies of many classes.

Reason Against Present Policy

The claims for the present policy have already been stated. In favor of the policy of awarding contracts only after public advertisement, there is, first the statutory requirement for the use of this policy on Government work, which, it is held in some quarters in Washington, has been violated by the War Department's order of Apr. 12, 1917. A second claim in favor of publicity is that there can be no complaint of collusion or favoritism, such as is now rife over many army contracts. A third claim is that, under existing statutes, the products of any manufacturing plant can be commandeered if bid

prices are considered too high. A fourth claim is that where great difficulty is experienced in getting goods of a desired quality at an early date, as was the case with cloth for uniforms about eight months ago, the fact would become known publicly and available supplies of a better quality which could be delivered more quickly could be bought at a slightly higher price without receiving public condemnation as extravagant.

The objection most frequently urged against the policy is that it will entail a serious loss of time, which is met by the assertion that purchasing by the Navy Department under this policy has been far more prompt, efficient and satisfactory to the sellers than the policy of the War Department, although the purchasing for the latter was done by leading men drawn from many lines of business and that for the navy was directed by a former newspaper man.

The general opinion is that Congress will favor the abolition of the present purchasing system of the War Department, and will not only require publicity regarding contracts, but will give back to some Government agent or agencies the powers over contracts now vested in various subcommittees working under the Council of National Defense. Whether that agent should be a Director of Munitions or the several large divisions of the War Department is being warmly debated in Washington. The recent changes in the Ordnance Department would point logically to a trial of the latter plan for ordnance, while it is quite generally held that so far as the Quartermaster's Department is concerned, the record of General Goethals at Panama warrants giving him an opportunity to show if that department can be sufficiently freed from red tape to become an effective organization.

Congress will certainly take some action, for the families of the boys in the camps and cantonments will insist on reform and the changes under way are evidently a response to the public protest against past conditions.

Proposes Use of Men in Army Prisons on Roads

Bill in Congress Would Make Available Much Labor for Military Highway Work

Prisoners in the United States Army and Navy prisons can be employed in the construction of military roads and highways upon the passage in Congress of legislation introduced at this session by Senator Hoke Smith, of Georgia. This is not to be confused with such employment of prisoners of war, for which no legislation is needed.

The bill authorizes the Secretary of War and the Secretary of the Navy to employ military prisoners in the manufacture of war supplies and in the construction of military roads, to make agreements for the use of necessary machinery and the finding of available material, and to supervise the work of county and state highway officials who may be charged with the development of the proposed roads.

Army prisoners already are employed on road work within the cantonments of the National Army. The bill will make possible their employment on roads leading to the cantonments. In many instances the cantonments are without good road connections with the railroads and main highways, making the transportation of supplies difficult in bad weather.

Auxiliary Water-Supply for Jersey City

Bids for an auxiliary water-supply of 5,000,000 gal. a day for three years, with the privilege of calling for an additional amount up to 12,000,000 gal., have been authorized by the city commission of Jersey City, N. J., on recommendation of Commissioner Michael L. Fagen, director of streets and public improvements. The auxiliary supply is designed to tide the city over during the proposed construction of a duplicate supply conduit from the Boonton impounding reservoir on the Rockaway River. The existing conduit has a nominal capacity of 50,000,000 gal. a day under normal operation conditions. It is estimated that incrustation has reduced the capacity to 47,000,000 gal. By means of pressure reduction the conduit may carry 55,000,000 gal. daily. For the first 11 months of 1917 the average daily consumption was 53,540,000 gal. The storage at the city end of the conduit is small. During the recent below-zero weather there was a serious shortage of water, due to heavy waste designed to keep service pipes from freezing. On Feb. 5 the city will receive bids for duplicating the old conduit beneath the Passaic and Hackensack Rivers. Plans are under way for duplicating the whole conduit, but the estimated time for construction is about three years.

Transactions in Lieu of Convention

The first of the three numbers of "Transactions" of the American Society of Municipal Improvements, designed to take the place of the 1917 convention, has been issued by C. C. Brown, secretary, 2535 North Pennsylvania St., Indianapolis, Ind. The second number is scheduled for January and the third for April. The present number contains reports of the secretary, treasurer and finance committee for 1916-1917, a report from the committee on sidewalks and street design, and papers on sewage-sludge pressing, contract forms to meet war conditions, financing street improvements, and requisites of an equitable law for street improvements. Discussions of these papers and the submission of additional papers, from nonmembers as well as members, are solicited by the secretary.

Join Local Engineering Society First

Membership in Local Recommended as Prerequisite to Acceptance in National Societies

The executive board of the Cleveland Engineering Society approved on Jan. 7 a recommendation of its intersociety relations committee (B. A. Stone, chairman) that membership in a local engineering society be made a prerequisite of membership in the national engineering societies. The report follows:

"It is evident, from many printed articles in the technical press, from utterances of public speakers and from the official actions of many technical societies, local and national, that there is a widespread and growing conviction that engineers by their training and equipment are especially qualified to direct and administer public works and civic affairs to the better advantage of the entire community.

"It is essential for the successful conduct of such service that there should be efficient organization and unselfish coöperation of the entire body of engineers. The foundation units of such an organization must be the local societies. For the majority of engineers their local interests are of the first importance. These affect most directly their conditions of living and their social relations as members of the community.

"It is necessary for the engineers of each community to act as a body before any efficient nationwide coöperation can be effected. Therefore, the first essential is the formation of strong local engineering societies. The national societies should draw their strength from the whole body of engineers. The national societies and local societies should be mutually supporting and not competitive. The national societies will probably always be divided along professional lines. The national societies can best promote the advance of technical knowledge. For the prosecution of those wider activities technical lines should be ignored and the national societies brought into the closet relations with the all-inclusive local societies.

"To this end we respectfully suggest that the national societies consider as a prerequisite to membership that a candidate shall show membership in an accredited local society.

"Your committee asks the approval of the above recommendation by the society, that this report be published and its consideration urged upon other engineering bodies endeavoring to promote coöperation."

Schwab Put On Bethlehem City-Planning Commission

The new city commission of Bethlehem, Penn., has created a city-planning commission consisting of Charles M. Schwab, president, Bethlehem Steel Co.; W. A. Wilbur and three others. Mr. Schwab is credited with having often expressed the desire to make Bethlehem the model industrial city of the world.

Railway Engineers Who Fought at Cambrai

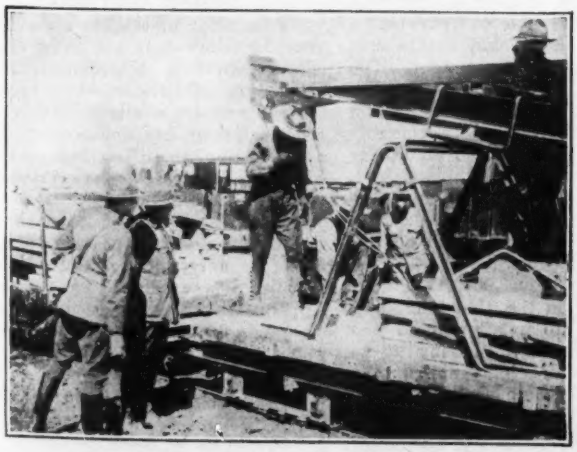
British Official Photographs

of some of the New Yorkers who dropped Spike Mauls for Rifles to help stem the late German drive

In this Group Besides CAPT. HULSART and LIEUTS. MCCLOUD and HOLSTROM at left, CAPT. H. W. HOLLAND (1), PRIVATE S. K. ALMY (2), CORP. WM. VAN V. STEPHENS (3), and SERGEANT MAC ISAAC (4), have been identified by friends and relatives.

Left to right, CAPT. C. R. HULSART, 1ST. LIEUT. PAUL MC CLOUD and 2ND. LIEUT. E. N. HOLSTROM.

SERGT. R. J. CAIROLA (left)
SERGT. NOW LIEUT. DONALD MAC ISAAC,
son of F. J. Mac Isaac, President of Smith, Hauser and Mac Isaac.



Recently one company laid ½ mile of standard-gage in 3 hr. 10 min., shortly after another beat this record by laying ½ mile in 2 hr. 45 min. The photograph shows narrow gage track-laying equipment.

The following extract from a letter written Mr. Mac Isaac by Col. Henry W. Hodge tells something about the battle:

"I want to write you a line of congratulation on the conduct of your son in the recent conflict with the Boches.

"Every one here says that but for his heroism and those who were with him from the.... Engineers, we might have had a serious fall back, but that he and Lieut. McCloud and a few others rallied their men and our allies and held the Boches. I hear the Allied Commander will probably give special recognition to this gallantry, and I am sure that you will be glad that your boy is one of the first to show that we Americans are going to do our part in this great struggle."

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Lower Court Rules Against Luten Patent

Complaint of Infringement of Five Bridge Patents Dismissed on Broad Grounds

The patent suit in which the State of Iowa, by special legislative enactment, took up the defense of an individual who was sued by Daniel B. Luten for infringement of certain of his concrete bridge patents, has been decided in the lower court against the patentee.

The suit was originally brought by Mr. Luten against the Marsh Engineering Co., Des Moines, Iowa, in 1912.

In 1913 the legislature enacted a law authorizing the governor to direct the attorney general to defend any suit involving the validity of a bridge patent, and pursuant to that law Henry E. Sampson, assistant attorney general at that time, was assigned to the case on behalf of the state. Wallace R. Lane, Chicago, was called in as associate counsel, and he finished the case as attorney for the defendant, together with H. M. Havner, the present attorney general.

Over 600 pages of printed testimony were taken, and 150 exhibits produced, including 15 miniature bridges which were made for the help of the court. On Jan. 3, 1918, Martin J. Wade, sitting as judge in the United States District Court for the southern district of Iowa, central division, dismissed the entire petition, involving eight of the Luten patents. Judge Wade's decision took up in detail four of the patents before the court, and the others were dismissed in the general ruling. Judgment was allowed against the complainant for costs. The specific patents mentioned by the judge in his decision were Nos. 852,970, 853,202, 853,203 and 934,411.

Judge Would Note Consent Decrees

The judge prefaced his decision with a criticism of "methods disclosed by the plaintiff in the business of constructing bridges or getting the business of designing bridges." He said, in part: "These methods no court can approve—some of them, at least. I am not sure but that they ought to be construed as sufficient to deny the party relief on the ground that he does not come into equity with clean hands. I refer especially to the half truths which are worse than falsehoods, in some of these representations made to contractors. Because when a man recites a list of cases as having been tried, or in which decisions have been rendered, without disclosing that nearly all of them have been consent decrees, it is not the truth. It is only half the truth. Those consent decrees should never have been utilized for any such purpose. It ought to appear upon their face stamped plainly 'by consent of parties,' and not be held out as the solemn action of the court which had never inquired into the facts at all." The judge further said that it was his opinion that in view of the disclosures in this case Congress ought to pass a law providing that the attorney general, or someone else, may institute a proceeding testing the validity of patents, settling the rights of parties on both sides, as to the validity and as to the construction of the patent.

As to the first group of claims under Patent No. 851,970, which provide for paving the bottom of the waterway under a bridge with a layer of concrete having a depressed end, the judge denied the validity of the claims on the ground that such paving, or such a handling of stream beds, was not new at the time the patent was granted. He said further that it did not need inventive genius to vary the details of that paving, as was done in the patent. The second group of claims under the same patent relates to the extending of spandrels and wing walls to a distance and height sufficient to hold the earth fill from escaping at the ends at the spandrels. The judge here stated that while he could not determine the particular things claimed as an invention, he could find no patentable novelty in the idea.

Design Is Not Invention

Judge Wade emphasized the difference between design and invention and pointed out that in judging whether things involve inventive genius the state of scientific knowledge in the work undertaken has to be considered. In his comment on Patent No. 853,202, which relates to a provision of tension members over the extended wall of an abutment to strengthen the structure at that point, the judge held that no variation in methods of reinforcement is patentable. The disposition of reinforcement, he said, is a matter of computation and one which any skilled engineer should be able to perform. If one man is more skillful than another and better able to figure out a certain method, he should not receive the monopoly rights of a patent. The same argument related to Patent No. 853,203, the claims of which are on a method of reinforcing a concrete arch. Here the judge stated that there may be some invention in this patent, but it is only for the particular arrangement of steel noted in the claims, and the bridge in question did not infringe this arrangement.

The final patent, No. 934,411, claims an improvement in the art of building a concrete wall up to a proposed line of projecting coping, allowing it to harden and then aligning the forms for the coping and completing it. The judge said that this was merely a form of camouflage and that there is nothing patentable in it.

A Protest from the Plaintiff

Mr. Luten has written *Engineering News-Record* protesting against one part of the decision. He says, in part:

"The court stated that consent decrees should have been stamped on their faces 'By consent of parties.' Not only has every decree to which I have given circulation been a certified copy of the decree as entered, but every decree obtained by consent has plainly stated that fact on its face, just as the court says should have been done. This is a fact which clearly appears in the record before the court. If the court had examined the record he would have found that I had done exactly as he says I should have done.

"In the case of Thacher vs. Polk County (235 Fed., 724) this same court held in 1916 that Thacher was estopped from maintaining suit for infringement because he had not warned infringers of the rights he was seeking to enforce against Polk County.

"The remarks of the court to the effect that Congress should enact a law giving the Attorney General power to proceed to test the validity of patents apparently overlooked the fact that the Attorney General has always had power to maintain suit to set aside and cancel patents on the very grounds that were charged against me by the counsel for the State of Iowa. The United States Supreme Court has decided that the Attorney General may bring suit in the name of the United States where a patent for a grant of any kind issued by the United States has been obtained by fraud, by mistake or by accident, or where there is any error in the patent itself capable of correction (128 U. S., 315, and 159 U. S., 548).

"I have given abundant opportunity for anyone to contest the validity of my patents, for I have filed 48 suits in all and have 27 pending at the present time. My litigation has not yet progressed beyond a few decisions in the lower courts, although I now have four cases pending in the Circuit Courts of Appeal."

Research Fellowships Open at Illinois University

At the close of the current academic year 12 fellowships are to be filled in the Engineering Experiment Station, University of Illinois. In addition to these, there are available two research fellowships in gas engineering in the same station, these last being supported by the Illinois Gas Association. For each of these fellowships is provided an annual stipend of $500, and all graduates of approved American and foreign universities and technical schools are qualified as applicants. Appointments are made and must be accepted for two consecutive college years, at the expiration of which time, if all requirements have been met, the degree of Master of Science will be conferred.

Nomination to these fellowships, accompanied by assignments to special departments of the engineering experiment station, will be made from applications received by the director of the station not later than the first day of February, this year. Preference is

given to those applicants who have had some practical engineering experience following their undergraduate work, but character, scholastic attainments and promise of success are considered.

Dean C. R. Richards has been informed by Dr. S. P. Capen, of the U. S. Bureau of Education, that the office of the Chief of Engineers has ruled that resident graduate students in engineering, who are candidates for an advanced engineering degree, may avail themselves of the privileges provided by the new regulations under which engineering students may be enlisted in the Enlisted Reserve Corps of the Engineer Department, and placed on the inactive list until they have completed their educational training.

Two Rapid-Transit Routes Recommended for Pittsburgh

Consideration of two rapid-transit lines in Pittsburgh form the main feature of a report just made by E. K. Morse, the city's transit commissioner, to the Council. One is to connect the South Hills district with the East End, extending from the south end of the present Mt. Washington tunnel through the tunnel, across the Monongahela River at Smithfield St., along Water St., Grant St., Penn Ave. and Franks-town Ave. to Dallas Ave. This line is to be built first. Later a line connecting the North Side with Schenley Park by way of West Diamond St., Dasher St., a bridge over the Allegheny River, Stanwix St., Diamond St., Forbes St. and Fifth Ave. is to be built.

The first line, 7.23 miles long, is largely elevated. Its cost is estimated at $7,000,000. The second line is largely in subway or tunnel, and is of considerably higher cost.

New England Water-Works Association Elects Officers for 1918

The candidates nominated for office by the nominating committee of the New England Water-Works Association were all elected by letter ballot without opposition. Carleton E. Davis, chief of the Bureau of Water, Philadelphia, was elected president; Willard Kent, civil engineer, Narragansett Pier, R. I., secretary, and Henry A. Symonds, hydraulic engineer, Boston, editor.

All of the other officials, the complete list of which was printed in *Engineering News-Record* of Nov. 8, 1917, p. 902, were elected.

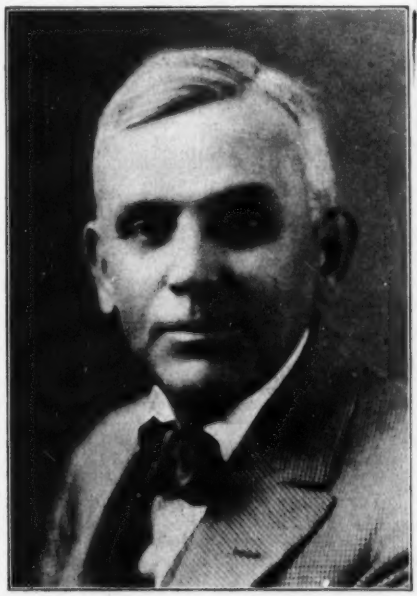
Road Builders To Hold Convention at St. Louis

The American Road Builders' Association will hold its annual meeting at St. Louis, Feb. 4 to 7, and the Missouri State Highway Department has decided to have its first "road week" at the same time and place. The department will have a laboratory in use for free testing of samples of rock and gravel, and will illustrate the road work of the Missouri convict camps.

Western Society President-Elect To Promote War Activities

Charles B. Burdick, president-elect of the Western Society of Engineers, purposes that his administration shall give full support in every way possible to military activities. One activity proposed is to enlarge greatly the employment bureau recently inaugurated.

Mr. Burdick was graduated from the University of Illinois in 1895, and began engineering work as assistant engineer to Alvord & Shields, consulting engineers, engaged principally on sewerage work. In 1897 he became assistant engineer to John A. Cole and from 1901 to 1902 was associate in the firm of John A. Cole & Son, consulting hydraulic engineers. In 1902 he entered into partnership with John W. Alvord.



CHARLES B. BURDICK

Some of the activities with which he has been connected are the complete water-works at Gary, Ind.; twenty years' work on the water-supply at Des Moines, Ia.; complete new water-works at La Crosse, Wis.; filter plants at Evansville, Ind., and Niagara Falls; flood protection reports for the Franklin County Conservancy District, Ohio, and for the Illinois Rivers and Lakes Commission. His latest work was done in connection with the construction of the Camp Grant cantonment at Rockford, Ill., his firm supervising water-supply, sewers and roads.

He has been a member of the Western Society of Engineers since 1901 and has served two years on its board of direction, one year as chairman of the hydraulic, sanitary and municipal section and one year as second vice president. He is a member of the American Society of Civil Engineers, the American Water-Works Association, the Illinois Society of Engineers, the Chicago Engineers' Club and the University Club of Chicago.

ENGINEERING SOCIETIES

Calendar

Annual Meetings

AMERICAN SOCIETY OF CIVIL ENGINEERS, 29 West 39th St., New York; Jan. 16 and 17, 1918, New York.

AMERICAN WOOD PRESERVERS' ASSOCIATION; Baltimore, Md.; Jan. 22-24, Chicago.

AMERICAN RAILWAY ENGINEERING ASSOCIATION; 910 Michigan Ave., Chicago; Mar. 20-22, Chicago.

CANADIAN SOCIETY OF CIVIL ENGINEERS; Montreal; Jan. 21-23, Montreal.

AMERICAN INSTITUTE OF MINING ENGINEERS, 29 West 39th St., New York; Feb. 18-21, New York.

AMERICAN CONCRETE INSTITUTE; 27 School St., Boston; Feb. 7-9, Chicago.

The next meeting of the Harvard Engineering Society of New York will be a smoker at the Harvard Club, Jan. 18. George F. Porter, engineer of construction of the St. Lawrence Bridge Co., will give an illustrated talk on the Quebec Bridge, and will also cover other types of bridges proposed, with a brief discussion of the merits of the various types and reasons for the selection of the present type.

The regular monthly meeting of the **Engineers' Club of Trenton, N. J.,** was held Jan. 10. The feature of the evening was a "Description of the New Power Plant of the Erie Lighting Co., at Erie, Penn.," by J. B. Scott, of Day & Zimmerman, Inc., illustrated with lantern slides. The club announced that in keeping with the spirit of the times the place of the annual banquet would be taken this year by a collation and smoker, on Jan. 24.

The Brooklyn Engineers' Club held its regular meeting for January on Jan. 10, and listened to a paper on "Car Float Transfer Bridges in New York Harbor," by James B. French. On Jan. 24 V. T. Goggin, engineer for Fred T. Ley & Co., builders of Camp Devens, Massachusetts, will address the club on the construction of the cantonment. The address will be illustrated with lantern slides.

The Yakima Engineers' Club of Yakima, Wash., at its first regular meeting, Dec. 29, discussed the importance of standard specifications for wood stave pipes, and creosoting thereof. Modern and up-to-date specifications are now entirely lacking, for general use of engineers and manufacturers. A committee, consisting of E. M. Chandler, chairman; T. A. Noble and C. F. Gleason, was appointed by President R. K. Tiffany, to prepare such specifications for consideration of the club.

meeting, listened to a paper B. D. Davis presented on "Modern Science." It was decided that the association shall have an exhibit at the first territorial fair. At the January meeting of the association a paper on "Tides" would be read, it was announced, by Charles B. Willard, United States engineer, who has been connected with breakwater work for many years.

The annual meeting of the New Jersey Sewage Works Association will be held in the State House in Trenton, Feb. 15. The program arranged includes an address on "The Operation of Small Sewage-Disposal Plants," by George W. Fuller, of New York City; a paper, "Difficulties Experienced and Overcome in the Operation of the Madison-Chatham Plant," by Paul Molitor, Chatham, N. J.; a paper on "The Operation of Sand Filters at Newton Under Winter Conditions," by Morford C. Smith, Newton, N. J., and one on "Sewage-Disposal Plant Operation in England," by Joshua Jamison, East Rutherford, New Jersey.

The American Association of Engineers, Chicago Chapter, Jan. 4, elected the following officers: President, T. B. Lambert; vice presidents, Paul Augustinus and Ferdinand Oudin; secretary, Robert W. Shelmire; treasurer, L. O. Wolf. S. A. Greeley, consulting engineer, Chicago, gave an illustrated address on "Housing the National Army," and John J. O'Leary, president of the Chicago Association of Commerce, spoke on "Patriotism and Production."

A joint meeting of the **Pittsburgh Sections of the Association of Iron and Steel Electrical Engineers** and the **American Institute of Electrical Engineers** will be held at the Hotel Chatham (old Hotel Lincoln), Pittsburgh, Jan. 19. Papers will be presented on the "Generation, Distribution and Consumption of Power," by B. W. Gibson and B. A. Cornwell, of the Ohio Works of the Carnegie Steel Co., Youngstown, Ohio, for the A. I. and S. E. E. "Methods of Power Factor Correction" will be discussed by R. A. McCarty, power engineer, Westinghouse Electric and Manufacturing Co., on behalf of the A. I. E. E. At the next regular meeting of the Philadelphia Section, A. I. and S. E. E., Feb. 2, the subject will be "Mill Type Transformers," by H. G. Steele, of the Pittsburgh Transformer Co., Pittsburgh. The next meeting of the Cleveland District Section will be held Jan. 26. The Pittsburgh Section will hold its February meeting at the Hotel Chatham, Feb. 16, and will listen to a paper on "A. C. and D. C. Skip by Hoists," by Mr. Lindquist, of the Otis Elevator Company.

The Michigan Engineering Society will hold its annual meeting at Grand Rapids, Jan. 29-31.

The annual meeting of the Municipal Engineers of the City of New York, to which ladies are invited, will be held in the Engineering Societies Building, 29 West 39th St., at 8.15 p.m., on Jan. 23. The business meeting will be followed by a lecture and entertainment.

The Washington Chapter, American Association of Engineers, met Jan. 7 for the first time since being chartered. A. P. Connor, secretary, was directed to edit and publish a journal to outline the work of the association. A committee was appointed to select a permanent club and meeting quarters. Several members spoke on the growing importance of engineers in the war.

The Carolina Association of Highway Engineers was recently organized by the highway engineers of North and South Carolina and the following officers were elected: R. T. Brown, president, Columbia, S. C.; W. M. Peyton, vice president, Rutherfordton, N. C.; N. C. Hughes, vice president, Gaffney, S. C.; N. S. Mullican, secretary, Lexington, N. C.; A. F. Brown, treasurer, Greensboro, N. C. The first regular meeting will be held at Chapel Hill, N. C., Feb. 20.

PERSONAL NOTES

JOHN T. FETHERSTON, commissioner of street cleaning, New York City, from August, 1914, to Dec. 31, 1917, has accepted the position of construction manager with the Air Nitrates Corporation, which is building an ammonium nitrate plant for the U. S. Government at Muscle Shoals, on the Tennessee River in Alabama, at an estimated cost of $30,000,000. Mr. Fetherston declined a temporary reappointment as street cleaning commissioner by Mayor Hylan.

THE MOODY ENGINEERING CO., Inc., formerly at 115 Broadway, is now at 90 West St., New York.

County Engineer SHINN, of Ocean County, New Jersey, has resigned his position to become assistant division supervisor of road work for the State Road Department. His division will include Ocean County.

ROGER W. OLMSTED has been appointed chief engineer of the South San Joaquin Irrigation District, California, succeeding A. GRIFFIN.

J. B. STOCKING has resigned as Carey engineer for the State of Idaho and has accepted the position of water master for the North Side Canal Co., Jerome, Idaho.

HERMAN SCHNEIDER, dean of the College of Engineering of the University of Cincinnati, and father of the "coöperative system" of engineering education, has been granted a leave of absence, and has been commissioned major in the Ordnance Department. He will be stationed at Washington, and will be in charge of the Industrial Service Division, which assists in caring for the labor needs and handling the labor problems in arsenals and in plants having ordnance contracts.

HERBERT SPENCER, engineer in the asphalt division of the road department of the Standard Oil Co. of New Jersey, has been commissioned captain in the Engineer Officers' Reserve Corps, and has been assigned to the engineer training camp at Camp Lee, Petersburg, Virginia.

RUDOLPH J. WIG, in charge of concrete tests and investigations of the Bureau of Standards, has been granted a leave of absence in order to assist in the concrete ship division of the Emergency Fleet Corporation. W. A. SLATER, formerly of the University of Illinois Engineering Experiment Station, who has been assisting Mr. Wig in his concrete ship studies at the Bureau of Standards, has likewise been transferred to the same division.

E. S. BORGQUIST, Salt Lake City, Utah, has received a commission as first lieutenant in the Engineer Officers' Reserve Corps.

FRANK M. MASTERS, inspecting engineer, Harrisburg, Pa., has been commissioned major in the Ordnance Officers' Reserve Corps.

W. B. MCARDLE has been appointed division engineer of the Central New England Ry., with headquarters at Poughkeepsie, N. Y., succeeding J. H. Gallivan, transferred to the middle division, New York, New Haven & Hartford R.R., at Boston.

JOHN W. TOWLE, Omaha, Neb., is now plant engineer with the U. S. Shipping Board at the Hog Island Shipbuilding plant of the American International Shipbuilding Corporation.

ROBERT CAMPBELL, engineer of erection for Milliken Bros., is now connected with the Downey Shipbuilding Corporation, at Arlington, Staten Island, New York.

E. MCLEAN LONG and FRANK MILLER, 13 Park Row, New York City, have dissolved their partnership and will continue in the practice of engineering under their individual names, with offices at the same address.

J. W. CRUIKSHANK, consulting engineer, Pittsburgh, Penn., has been commissioned a captain of engineers, and is now at Camp Lee, Petersburg, Virginia.

JOHN W. F. BENNETT, after eight years' service with the City of New York, first as deputy commissioner of water supply and later as consulting engineer, is now associated with ERNEST P. GOODRICH and A. PEARSON HOOVER, consulting engineers.

BISHOP MOORHEAD, of Las Animas, N. M., has received a commission as second lieutenant in the Engineer Officers' Reserve Corps.

B. G. McBRIDE, assistant state engineer of Nevada, left Jan. 1 for Washington to take examinations for a commission in the ordnance department.

J. G. SCRUGHAM, state engineer of Nevada, was recently commissioned as major in the ordnance department.

CHARLES E. WHITNEY, formerly chief inspector at Pittsburgh, Penn., for Modjeski & Angier, inspecting civil ngineers, is now a first lieutenant in the Ordnance Officers' Reserve Corps, and has been assigned to inspection duty in New England.

L. V. MANSPEAKER, assistant engineer, Chicago and Alton R.R., at Springfield, Ill., is now a captain in the Engineer Officers' Reserve Corps.

LEWIS HALL, Morrisville, N. J., has been appointed borough engineer for a period of one year. He succeeds THOMAS B. STOCKHAM.

CHARLES P. COLE, Prince Bay, N. Y., has been appointed superintendent of sewers for the Borough of Richmond, New York City.

ROBERT L. FOX, Philadelphia, has been appointed city engineer for Bethlehem, Pennsylvania.

DABNEY H. MAURY, hitherto acting as consulting engineer in the cantonment division of the Quartermasters Department, has been commissioned a major and assigned to active duty in the cantonment division.

KARL R. KENNISON has left the designing division of the Water Supply Board, Providence, R. I., and has been appointed supervising engineer, Bureau of Yards and Docks, Navy Department. He has been detailed for duty at the Blake & Knowles Pump Works Extension, East Cambridge, Massachusetts.

MAJ. FREDERICK MEARS, who has been a member of the Alaskan Engineering Commission for the past three years and in charge of the work at Anchorage, has been relieved, at his own request, of the duties in connection with that position. Maj. Mears had been specially detailed to the Alaska R.R. work from the War Department, but felt that in the present time of stress he should return to the Army. The War Department is to commission him a colonel and place him in command of the engineering regiment which is to be engaged in railroad work in France.

WILLIAM GERIG has been appointed engineer in charge of the Anchorage Division of the Alaska R.R., under the supervision of WILLIAM C. EDES, Chairman of the Alaskan Engineering Commission. Mr. Gerig has been for the past two years with the commission in the capacity of consulting engineer, and previous to that time had been for many years vice president and chief engineer of one of the Hill lines in the Northwest. He had also been for some time with the Panama Canal as engineer in charge of one of the construction divisions.

CHARLES E. COOKE, of the U. S. Geological Survey, Washington, D. C., has been commissioned major in the Engineer Officers' Reserve Corps.

MALCOLM McLAREN, of Princeton, N. J., is now Captain McLaren of the Engineer Officers' Reserve Corps.

R. E. SPEAR has accepted the position of assistant engineer to R. W. ROBERTS, who is district engineer of the Michigan State Highway Department.

W. R. HOLWAY has resigned as sanitary engineer in charge of the water purification plant and the sewage disposal plant of Alliance, Ohio, and is now in charge of the new filtration and softening plant of the City of Tulsa, Oklahoma.

K. I. STEARNS has left the position of assistant hydraulic engineer at the Massena, N. Y., station of the St. Lawrence River Power Co., and is connected now with the engineering department of the American Sheet and Tin Plate Co., Pittsburgh.

M. H. TURNER, former service director, was elected city manager of Ashtabula, Ohio, to succeed J. WARREN PRINE.

WIHTRED COOK, formerly with the engineering department, Rochester Railway and Light Co., Rochester, N. Y., is now with the hydraulic engineering department, Aluminum Co. of America, Pittsburgh, Pennsylvania.

CALVIN E. COCK, formerly of Fort Worth, Tex., is now at Spur, Tex. He has been appointed engineer on a $400,000 road bond issue recently voted in Dickens County, Texas.

JAMES H. REDING, formerly assistant engineer for R. Winthrop Pratt, consulting engineer, Cleveland, Ohio, is now captain of A company, 112th Engineers, at Camp Sheridan, Alabama.

LOUIS F. HAFFEN, at one time president of the Borough of the Bronx, New York City, has been appointed consulting engineer of the borough.

WALTER E. SANFORD, formerly with the Public Service Commission, New York, First District, is now with Mason & Hanger-MacArthur Bros., at the Port Newark Terminal, Port Newark, New Jersey.

A. S. MIRICK, formerly of Denison, Iowa, is now in the office of the Nebraska state engineer, Lincoln, Nebraska.

FRANCIS E. DANIELS, assistant engineer with the Pennsylvania State Department of Health, has been commissioned captain in the Sanitary Corps of the National Army, and has been assigned to Camp Greene, Charlotte, North Carolina.

CAPT. F. R. SCHANCK, who has been commissioned in the Ordnance Department, has been assigned to duty as chief of the district of the production section, carriage division, Chicago. Capt. Schenck had been connected with engineering work on the irrigation operations of the Interior Department for a number of years, and at the time of being commissioned was assistant chief engineer, and also in charge of mechanical engineering for the irrigation work at the Indian Bureau.

CHARLES J. BOLAND, for the past two years constructing engineer of C. P. Boland Co., engineers and contractors, Troy, N. Y., is now first lieutenant in the Signal Corps, Construction Department, "Somewhere in France" with the American expeditionary forces.

CAPT. CHARLES GARTENSTEIN, who was until recently engineer of design in the office of the President of the Borough of the Bronx, New York City, is now a member of the Engineer Officers' Reserve Corps, and has been assigned to the officers' training camp at Petersburg, Virginia.

HARRY C. DUDLEY, Duluth, Minn., and ABNER GILE WITHEE, Watertown, Fla., have been commissioned captains in the Engineer Officers' Reserve Corps.

CHARLES HERBERT SWEETSER, of the U. S. Office of Public Roads, Washington, D. C., has received a commission as captain in the Engineer Officers' Reserve Corps.

FREDERICK H. KRUGER, Alameda, Calif., and WHITNEY NEWTON, Dulce, N. M., have received commissions as first lieutenants, Engineer Officers' Reserve Corps.

SANFORD E. THOMPSON, consulting engineer, Boston, Mass., has been commissioned a major in the Ordnance Department of the Army.

LEO F. CAPRONI, formerly with the National Bridge Works, New York, is now with the New York office of the Bethlehem Steel Company.

BYRON J. LAMBERT, professor of structural engineering in the State University of Iowa, has been commissioned major with the 23d (Highway) Engineers and is now at Camp Meade, Maryland

W. L. MALONEY, supervising engineer on the construction of Camp Grant, has now received his commission as Major in the Quartermasters Department of the National Army and been assigned to the Cantonment Division.

H. H. TRACY, city engineer of Norfolk, Neb., has closed his office and joined the colors in the capacity of first lieutenant of the Engineer Officers' Reserve Corps. He is at Camp Lee, Va., for a three months' training course.

B. J. T. JEUP, who has been city engineer of Indianapolis during the administration of Mayor Joseph T. Bell, the present incumbent, and who retired from office Jan. 14, has been appointed chief engineer of the Indianapolis Water Co. Mr. Jeup has been serving the City of Indianapolis as assistant city engineer or city engineer during several administrations.

OBITUARY

JAMES MACDONALD, age 107, Canada's oldest contractor, builder of many large docks and wharves, and of many big grain elevators, died at Collingwood, Ont., recently.

SAMUEL J. STILWELL, electrical and construction engineer and grading contractor, a resident of Seattle, Wash., for 28 years, died Dec. 25. Mr. Stilwell was 58 years old and was active in contracting circles. In early days in Seattle, he was superintendent of the Bell Telephone Co. His greatest work in Seattle was the regrading of Denny Hill, as member of the firm of Grant, Smith & Stilwell. Stilwell Bros. also graded that portion of the Lake Washington Government Canal between Lake Washington and Lake Union.

GEORGE W. RAPP, senior member of the firm of Rapp, Zettel & Rapp, architects, died at his home in Cincinnati, Ohio, Jan. 10, at the age of 66 years. Mr. Rapp was a charter member of the Cincinnati Chapter, American Institute of Architects, and during the years 1912 and 1913 was building commissioner of the City of Cincinnati. During his term of office the Housing Department for the inspection of tenements was organized, and he also conducted an active campaign of careful inspection of amusement places which resulted in increasing the standard requirements governing theaters.

INDUSTRIAL NEWS AND COMMENT

Good Roads Are Urged by Motor Truck Men

Manufacturers in Convention Emphasize Need for a Strong Construction Program To Promote War-time Hauling

"Although $1,800,000,000 has been spent on highways in the United States during the last ten years, we are totally lacking in adequate motor-truck routes between our large cities and distributing points," said Roy D. Chapin, chairman of the Highways Transport Committee of the Council of National Defense, addressing the Motor Truck Manufacturers' Convention in New York, on Jan. 8.

There were 110 delegates present, representing 70 manufacturers of motor trucks. The keynote of the meeting was war service. Resolutions were adopted tendering the services of the motor truck manufacturers to the President, to the Secretary of War and to the Council of National Defense. A program of constructive motor-truck legislation was outlined, and resolutions were passed to further this work.

Spirited discussion dealt with the vital need for immediate and widespread good road construction to expedite the war work of the nation by relieving traffic congestion. Several noted speakers dwelt upon this phase of wartime construction.

Mr. Chapin's address was upon the work of the Highways Transport Committee of the Council of National Defense. He outlined the great need for transportation and adequate roads, properly maintained, in order to win the war. In selecting a route for the overland transport of army motor trucks, he stated, there were encountered many gaps of impassable roads which had to be rebuilt and other stretches which had to be repaired. In one or two states there were good roads, suitable for a through route, which were not charted on the state highway maps.

TRUCKS TO CARRY SHIP'S PARTS

Further need for permanent road construction of a type to withstand the heaviest traffic was evidenced by the fact that the Highways Transport Committee of the Shipping Board has asked that the war trucks which are being driven overland shall carry the parts of ships now urgently required at the Atlantic seaboard.

Coöperation between highway engineers and the motor-truck industry in the design and construction of modern highways was urged by George C. Diehl, chairman of the Good Roads Committee of the American Automobile Association.

"Motor truck roads," said Mr. Diehl, "must be built on the shortest practicable route in order to cut the cost of truck freighting to a minimum. Volume of traffic, grades and load distribution on the trucks must be considered before the width and type of road are chosen. Bridges should be taken out of the control of counties and placed under state or Federal jurisdiction. Many of our present bridges are unable to carry loads which may be transported over the roads, due to county control of bridge work.

ROADS MUST WITHSTAND HEAVY TRAFFIC

"The roads of today must be built with a concrete base and a top that will withstand the heavy loads of motor trucks."

Parallel roads to care for important intercity traffic were pointed out by Mr. Diehl as a modern need.

S. M. Williams, of the Garford Co., also appealed for the immediate building of national highways able to care for motor-truck traffic. During the next year the increased freight hauling by motor truck will be too much for the present system of highways to withstand.

"Legislation Affecting Use of Motor Trucks" was covered by Windsor T. White, chairman of the National Automobile Chamber of Commerce Commercial Vehicle Committee. Mr. White asked for a Federal statute controlling motor-truck operation in every state.

At present motor trucks of a type free to operate in one state are barred by local laws from working in other states.

Coöperation between the motor-truck manufacturers and the state and national associations interested in highway development was urged by Mr. White.

Maj. Edward Orton, Jr., Quartermasters Corps, U. S. A., told of the great work of driving 30,000 motor trucks overland, of which the first convoy has just gone through. "One great benefit of these 'drive-aways' will be the enlightenment of the citizens regarding the need for overland motor routes capable of withstanding motor-truck traffic," said Major Orton. "It will make clear, too, the necessity for roads that actually lead somewhere and do not branch out to obscure points, as do roads built under individual road-building programs of our several states. This need has long been evident, but these war trucks will help to bring it to the fore and result in the great development of our national highways."

For the Man Who Is "Sold Up"

An interesting suggestion to the manufacturer who is "sold up" was made the other day by a man who is in close touch with the industrial field.

"Good operators for trenching machines, steam shovels and locomotive cranes are scarce and becoming scarcer," said he. "Equipment at work now is not getting the skilled attention that it needs to get the most service out of it. Used or second-hand equipment that has changed several times is likely to deteriorate fast.

"In consequence, I believe that it would pay the manufacturers to keep a skilled service man on the road to follow up the machines that have seen several years' use. Let him show the operator how to 'hunt trouble' on the machine, how to make simple repairs and adjustments, when to 'shop her' and how to instruct the shop force regarding repairs, for the shop mechanics in the average organization contain a big percentage of green men these days, too.

"This field service will prolong the life of the equipment, thus adding to war-time conservation of materials. It will also be a powerful factor in building good will for the manufac-

turers of construction equipment who adopt it. To the manufacturer who is 'sold up' this good will, particularly among second-hand owners, is a valuable asset."

These comments seem worth while passing along to the readers of this page. It would be interesting to hear from manufacturers who are already working along these lines.

Licenses Required for All Shipments of Wire Rope

A notice has been issued by the War Trade Board regarding exports of wire rope, classified as galvanized wire, without an export license. The attention of shippers is called to the fact that export licenses are required for all shipments of iron and steel wire rope, cable and strands consisting of six or more wires, whether or not the wires are painted, galvanized or coated in any way, and that it is necessary to obtain an export license for every shipment of this material. Notice is also given that the act of improperly classifying material in order that it may be exported without a license subjects the exporter to the penalty of the law.

Notes of the Industries

H. Y. Smith, engineering superintendent for James Kennedy, contractor, Fargo, N. D., has joined the staff of Kern-Hunter, Inc., dealer in contractors' equipment, Milwaukee. Mr. Smith was in the contracting business in New Jersey for 12 years. J. N. Young, formerly Chicago manager for the Mechanical Appliance Co., is handling the Central Wisconsin territory for this company.

The Frampton Window Shade Co., Pendleton, Ind., has been succeeded by Hamilton Manufacturing Co., Anderson, Ind.

After an existence of nine years as a department of the Chicago Pneumatic Tool Co., the motor truck interests of the company were taken over on Jan. 1 by a new organization known as the Little Giant Truck Co. The latter is owned and controlled by the Chicago Pneumatic Tool Co. and the officers are the same, W. O. Duntley, president; W. B. Seelig, secretary and L. Beardsley, treasurer, with T. J. Hudson, sales manager. The headquarters will remain in the Little Giant Building, 1615 Michigan Ave., Chicago.

Ralph C. Davison, for the past six years associated with the American Mason Safety Tread Co. in a selling and engineering capacity, has resigned his position and directorship to become associated with the American Abrasive Metals Company, makers of Feralun Safety Treads and Anti-Slip surfaces. Mr. Davison, through his connection with the Concrete Association of America, has a large acquaintance among architects and contractors, and as associate editor of the "Railroad Gazette" made many friends among railroad men.

The Marsh-Capron Manufacturing Co., Chicago, manufacturers of the Marsh-Capron "rail track" mixer and other concrete machinery, has "Linked up with Lakewood" (as the Lakewood slogan has it). The Lakewood "M-C Line" will be the new name of the company's equipment.

J. D. Cardinell announces that he has purchased the vellum manufacturing department of the Cardinell-Vincent Co., which he has organized to manufacture and distribute vellum paper exclusively, under the name of the Cardinell Vellum Manufacturing Company.

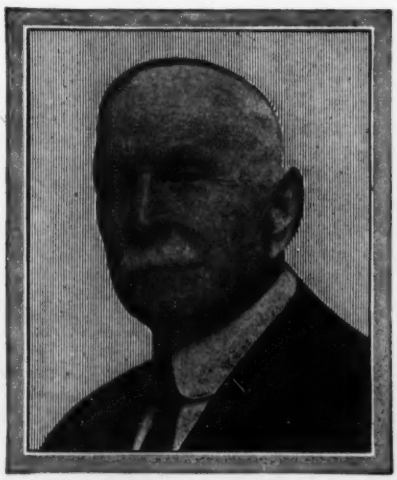
The Glauber Brass Manufacturing Co., of Cleveland, plans to erect a reinforced concrete building, 150 x 300 ft. The building will be required for occupancy on Apr. 1.

On Jan. 1 there were 1417 stars in the service flag of the American Sheet and Tin Plate Company.

Christopher W. Levalley Dead

Christopher W. Levalley, founder and chairman of the board of directors of the Chain Belt Co., died suddenly of heart failure at his home in Milwaukee, Jan. 4.

Mr. Levalley was born at Manchester, Conn., in April, 1835, and received his education in the schools there. When 14 years old he moved to Hartford, Conn., where he served an apprenticeship in a machine shop. At the outbreak of the Civil War he enlisted in the army. After the war he went to St. Paul as superintendent of the St. Paul Harvester Co., later becoming general manager. It was at this time that he saw the necessity of a positive drive for harvesting machinery, and in 1891 he went to Milwaukee, where he established the Chain Belt Company.



CHRISTOPHER W. LEVALLEY

In 1907 Mr. Levalley conceived the idea of driving a concrete mixer with a steel chain and using a cast semisteel drum. These ideas were incorporated in what was known then as the Chain Belt Mixer, but which name has since been changed to Rex Mixer.

Mr. Levalley was 82 years old last April. From 1891 until 1917 he was president and general manager of the Chain Belt Co. In 1916 he was elected chairman of the board of directors and held this position to the time of his death. He was also interested in the C. O. Bartlett & Snow Co., Cleveland, and the Federal Malleable Co., Milwaukee.

Mr. Levalley gave generously to charitable institutions and only within the past year gave $100,000 to the Milwaukee Foundation.

J. Howard Murray, former owner of the Trenton Vise and Tool Works, died in Trenton, Dec. 18. Mr. Murray was also formerly associated with his son, Gen. C. Edward Murray, in the Crescent Insulated Wire and Cable Co.

TRADE PUBLICATIONS

"The Modern Freighter" is the title of a folder issued by the United States Motor Truck Co., illustrating the work of United States trucks on intercity hauls.

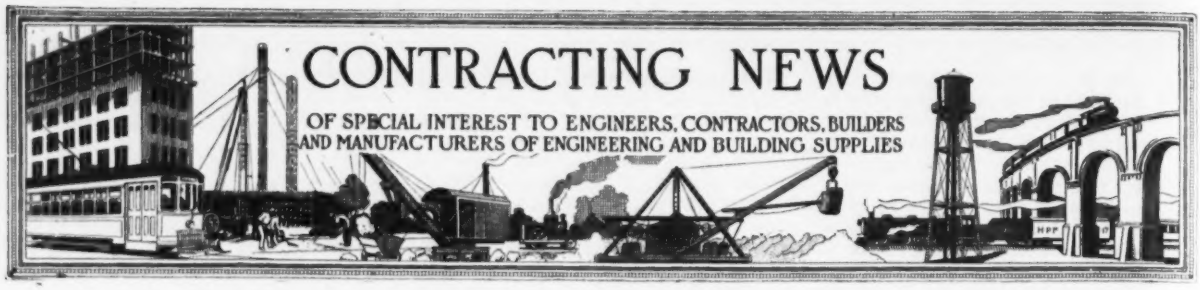
"My Dear Jim" is the title of a pamphlet just issued by the Carnegie Steel Co. It is as good as it sounds. As P. B. Woodworth, advertising manager, says in his accompanying letter, the Carnegie Steel Co. yearly prints and distributes 23 publications, each covering a specific field in detail. The new pamphlet is intended to make clear the full scope of the company's activities in a wide range of specialized fields. The facts are interesting and of a nature seldom presented in a trade publication.

"How To Make and Use Concrete" is the title of a handbook issued by the Ransome Concrete Machinery Co., 115 Broadway, New York. The author is H. Colin Campbell, C. E., E. M. A wide range of concrete construction and every stage of construction are covered. Attention is given to selection of aggregates. Plans and bills of material are shown for a semi-portable gravel washing plant. Reinforcing of various types is discussed and tables of quantities of materials are given for building and paving work. The handbook costs $1.00.

APPLIANCES AND MATERIALS

A Correction

In the description of "Bloxonend" published last week in this column, the sentence which should have read "The blocks are made up in sections about 8 ft. long" was printed "8 in. long," owing to a typographical error.


CONTRACTING NEWS
OF SPECIAL INTEREST TO ENGINEERS, CONTRACTORS, BUILDERS
AND MANUFACTURERS OF ENGINEERING AND BUILDING SUPPLIES

Proposals

For Proposals Advertised See Pages 59 to 61 Inclusive

WATER-WORKS

Bids Close		See Eng. News-Record
Jan. 22.	Geraldine, Mont.	Jan. 3
Jan. 22.	Ft. Worth, Tex.	Jan. 10
Jan. 25.	Franklin, Minn.	Jan. 10
Jan. 26.	Elizabeth, N. J.	Jan. 17
Jan. 28.	Columbus, O.	Jan. 17
Jan. 31.	Peoria, Ill.	Jan. 17
Feb. 5.	Jersey City, N. J.	Dec. 27

SEWERS

Jan. 19.	Hagerstown, Md.	Jan. 10
Jan. 21.	Anniston, Ala.	Jan. 10
Jan. 21.	Marquette, Kan.	Jan. 17
Jan. 24.	Owensboro, Ky. Adv. Jan. 10.	Jan. 10
Feb. 1.	Toledo, O.	Dec. 13
Feb. 5.	Phillipsburg, N. J. Adv. Jan. 3 and 10.	Jan. 3
Feb. 5.	Texarkana, Tex.	Jan. 17
Feb. 6.	Twin Falls, Idaho	Jan. 10

BRIDGES

Jan. 20.	Wrightstown, Wis.	Jan. 17
Jan. 21.	Gering, Neb.	Jan. 3
Jan. 22.	North Platte, Neb.	Jan. 3
Jan. 22.	Glenville, W. Va.	Jan. 10
Jan. 23.	West Point, Neb.	Jan. 3
Jan. 24.	Center, Neb.	Jan. 3
Jan. 25.	Wayne, Neb.	Jan. 10
Jan. 28.	McCook, Neb.	Jan. 3
Jan. 30.	Dundee, Ill.	Jan. 17
Jan. 31.	Dyersville, Ia.	Jan. 17
Jan. 31.	Romney, W. Va.	Jan. 10

STREETS AND ROADS

Jan. 21.	Lansing, Mich. Adv. Dec. 27.	Dec. 27
Jan. 21.	California	Jan. 10
Jan. 21.	Santa Barbara, Cal.	Jan. 10
Jan. 21.	Iroquois, Ont.	Jan. 10
Jan. 22.	Pennsylvania Adv. Jan. 3 and 10.	Jan. 3
Jan. 23.	Baltimore, Md.	Jan. 17
Jan. 24.	Jonesboro, Ark.	Jan. 10
Jan. 25.	Henderson, Ky.	Jan. 10
Jan. 28.	California	Jan. 17
Jan. 31.	Key West, Fla.	Jan. 10
Feb. 1.	Cincinnati, O.	Jan. 17
Feb. 5.	Tallahassee, Fla.	Jan. 17
Feb. 5.	Indiana	Jan. 17
Feb. 14.	Evening Shade, Ark.	Jan. 17

Bids Close		See Eng. News-Record

EXCAVATION AND DREDGING

Jan. 25.	Henderson, Ky.	Jan. 10
Jan. 29.	Walker, Minn.	Jan. 10
Jan. 29.	Sibley, Ia.	Jan. 17
Feb. 5.	Albany, N. Y.	Jan. 17

BUILDINGS

Jan. 18.	New Haven, Conn.	Jan. 3
Jan. 24.	Defiance, O.	Jan. 3
Jan. 24.	Lima, O.	Jan. 17
Jan. 28.	Norwalk, Cal.	Jan. 17
Jan. 29.	Fresno, Cal.	Jan. 17
Jan. 31.	Albany, N. Y.	Jan. 17
Feb. 11.	Columbus, O.	Jan. 17
Feb. 15.	Duluth, Minn.	Dec. 27
Mar. 1.	Wassau, Wis.	Jan. 17
Mar. 8.	Rice Lake, Wis.	Jan. 17
Apr. 1.	Springfield, Mass.	Jan. 17

FEDERAL GOVERNMENT WORK

Jan. 21.	Post Office — Alexandria, La.	Jan. 17
Jan. 21.	Radio Towers and Tanks—Barataria, La.	Dec. 20
Jan. 21.	Dredging—San Francisco, Cal.	Jan. 3
Jan. 21.	Pit for Furnace—Charleston, W. Va.	Jan. 17
Jan. 28.	Post Office—Sunbury, Pa.	Dec. 6
Jan. 28.	Marine Railways—Boston, Mass.	Jan. 10
Jan. 28.	Marine Railway—Charleston, S. C.	Jan. 10
Jan. 28.	Gates—Louisville, Ky. Adv. Jan. 10.	Jan. 10
Jan. 31.	Wharf—Ft. Adams, R. I. Adv. Jan. 10.	Jan. 10
Feb. 1.	Dredging — New Orleans, La. Adv. Jan. 10.	Jan. 10
Feb. 5.	Excavators—Denver, Colo.	Dec. 27
Feb. 6.	Post Office — Pittsburgh, Pa.	Jan. 10
Feb. 11.	Dredging—New York, N. Y.	Jan. 17

MISCELLANEOUS

Jan. 21.	Cement and Asphalt—Hamilton, Ont.	Jan. 17
Jan. 24.	Coal Bunker — Cleveland, O.	Jan. 17
Jan. 29.	Waterway Improvements—West Palm Beach, Fla.	Jan. 10
Jan. 29.	Street Lighting System—New York, N. Y.	Jan. 17
Feb. 11.	Harbor Improvement—Mobile, Ala.	Dec. 27
Mar. 11.	Tunnel—Los Angeles, Cal.	Jan. 3

Where name of official is not given, inquiries should be addressed to City Clerk, County Clerk or corresponding official.

WATER-WORKS

Proposed Work

Mass., Springfield—City plans to build storage reservoir on Granville water shed. F. H. Clark, city engr.

N. J., Flanders—Town plans to build new water-works system.

N. J., Hightstown—Boro. plans to improve water system, including new power equipment.

Pa., Pottstown—Pottstown Water Co. acquired 50-acre tract in West Pottstown and plans to extend system, including increase in capacity of filtration plant about 50%.

Pa., Williamsport — Williamsport Water Co. plans to extend and improve its plant. About $250,000.

Va., Norfolk—City leased docks to Government and will furnish water to terminals and naval base at Pine Beach; also plans to connect all city lakes, lay larger mains from pumping station to naval base and provide additional pumping facilities. W. H. Taylor, Jr., city engr.

Ala., Oneonta—Alabama Water Co. purchased plant of Oneonta Utility Water & Light Co. and will improve same by installing pumps, mains, and hydrants.

Mich., Flint—City voted $128,000 bonds to build water system. E. C. Shoecraft, city engr. Noted Aug. 30.

Ia., Des Moines—City plans to build new water-works plant changing source of water supply from Raccoon River water shed to Des Moines River. K. Kastberg, city engr.

Ia., Twin Falls—(Official) — City election Jan. 30 to vote on $375,000 bonds to build water system, involving 24 in. diameter supply line of California redwood, from filtration plant to city, 2 mi. long, about 6 mi. 8-10 in. c.i. mains in business district, 10 mi. 4 in. California redwood mains in residential district; also 83 new fire hydrants. W. A. Minnick, clk. Noted Jan. 3.

Tex., Brady—City voted $25,000 bonds to build water-works plant and distributing system. Noted Dec. 27.

Tex., Corsicana — City plans to issue $400,000 bonds to build water system. Noted May 17.

Tex., Port Arthur—Port Arthur Light & Power Co. plans to install water treating plant. About $16,000.

Idaho, Buhl—City plans to install new water supply system. If water is brought from Antelope Springs it will necessitate 40 mi. pipe line and cost $350,000; if supply be taken from Clear Lake it will cost between $80,000 and $100,000. Burns & McDonnell, 400 Inter State Bldg., Kansas City, Mo., engrs.

Wash., Seattle — Council appropriated $11,400 to extend water system. A. H. Dimock, city engr.

Cal., Tropico—City plans to issue $100,000 bonds to build water system and purchase electric equipment. Noted Oct. 25.

A Consolidation of Engineering News and Engineering Record — McGraw-Hill Company, Inc.—JAMES H. McGRAW, *President*

ENGINEERING NEWS-RECORD

A WEEKLY JOURNAL
DEVOTED TO CIVIL ENGINEERING
AND CONTRACTING

Volume 80 — NEW YORK, THURSDAY, JANUARY 24, 1918 — Number 4

Most Drastic of Government Mandates

THE Fuel Administrator's drastic order has been and will be obeyed. Patriotism, however, should not blind us to the fact that his decree shutting down industry first for a period of five days and then for nine successive Mondays is the most drastic order our Government has ever issued.

While canvass of industries well scattered through the chief industrial section of our country demonstrates willingness to submit to the order, there is far from general agreement as to its probable necessity. Certainly, the way in which it was given out lacked diplomacy and an appreciation of the psychology of the American people. Had the President been chiefly responsible for the order, no such blunder would have been made. He has consummate ability in presenting big situations to the country.

Nevertheless, the effect of the order is so tremendous that the Fuel Administrator must have foreseen the need of making a defense. The fact that he did not do so until the order was issued raised the suspicion that he made the decision without having exhausted all less-drastic alternatives. It now appears that the course adopted had long been under consideration, and that the primary object was to show the country's production and prevent increased seaboard congestion.

While freight congestion, due to lack of shipping, and perhaps to lack of coördination in the handling of shipping, may be the immediate reason for this drastic procedure, in the last analysis the trouble lies with the faulty railroad regulation which for ten years has prevented the expansion of transportation facilities. For this policy the railroad commissions are responsible and beyond them the people themselves.

It is not much consolation at this late date to place the blame squarely, but it may do some good if the public at large is awakened to the true cause for its present suffering. Could this be indelibly impressed upon all voters, there would be less advocacy of the permanent retention of the railroads by the Government.

Centralize the Housing Authority

GOVERNMENT funds for housing war workers have been slow in coming. For months the need has been great, but the voices of the few experts crying in the wilderness have not been able to break down official conservatism at Washington. Now at last the Shipping Board has made the first step and there is hope that the War Department or the Council of National Defense, or whoever is to control the munitions works, will follow its lead. The best results cannot be secured unless the entire housing program is put under one central body composed of experts who, while taking advice as to general needs from the departments concerned, will have the final say as to the design and control of the new towns that must be built. Only in this way can the housing problem be worked out. It has long since passed the stage of a local problem. That it is a part of a stupendous social program is well recognized in the other warring countries, and not to accord such recognition here would be to fail to see beyond the day peace is signed. Diverse authorities cannot be expected to have this broad foresight, but a rightly selected housing commission will have it in large measure, and can in addition be so constituted as to bring to the tasks of immediate construction a much-needed experience in such work.

The Readjustment of Business

THE readjustment of the industrial life of this country to war conditions has been carried out by jerks and starts. Much grinding of machinery and stripping of gears has taken place in the achievement of even such small results as are boasted of by cabinet officers. The real problem has not been so much as stated by the Administration, which has attacked industry as it would a refractory mule, with a club instead of with a bridle. As against the dictum that you *can* run your non-war business without actually breaking the law until the Government finds time to shut you up, we must come to the principle that every patriotic man *must* continue to run his non-war business until the Government can find some way to make use of the investment and labor involved to help win the war. If we are going to win the war, we must keep busy. We must produce faster than any other nation. If the Government is not ready yet to convert even a large fraction of our industry to the production of war exports, because we have no means of transporting them, it is destructive to say, with Doctor Garfield, that *all* production must be curtailed.

It must be realized that the country's economic life, to be healthy, must be uninterrupted. Let us no longer put the question, is so-and-so essential? Let us ask rather, how can we *use* so-and-so to win the war? When these questions are fairly asked by the Administration they will answer themselves. There will be no more rail congestion because the Government is buying things it cannot transport or use. There will be no more rendin

and tearing of the economic structure such as is involved in the present fuel order. For ships will leave our ports fully coaled and laden, munition factories will work at constantly increasing speed, and other plants will produce the maximum quantity of wealth attainable with the remaining labor in order to sustain ourselves and our allies against the day of the triumph of our ideals.

Which Highway Projects Will Receive Federal Aid in 1918?

ON PAGE 163 are the questionnaire and the letter of transmittal sent out to all district engineers by the Office of Public Roads and Rural Engineering. This has been done in order that the distribution of the federal-aid funds during this year may not act to interfere with the progress of the war. But it is more than that, for it is easily conceivable that the funds might be withheld if the capital and man power that is represented by them could be better used. To have decided that highway construction should go on when every ounce of strength should be devoted to the hastening of victory is an acknowledgment that the highway system of the country is of vital importance. It is a recognition on the part of the Government that without roads the transportation network is incomplete.

To many the inevitability of this action has been apparent for some time. When Priority Order No. 2 was issued and it became apparent that its enforcement would mean the discontinuance of all construction work on highways, there was universal protest against its severity. It was felt that not the fullest judgment lay back of an action that threw out of work so many men and left in chaos so much activity that had been started in greatest faith.

Calmer viewing showed the practical necessity of the order, and resulted in a feeling that a slackening of the immediate tension on the railroads would see the resumption of at least the construction that had been started. This hope was justified when, on Jan. 1, all priority orders were revoked, allowing road work to proceed, but under the disadvantages of the closed season. The terms of the revocation were vague, in that they did not guarantee that road materials would be given consideration. The action of the Office of Public Roads comes, therefore, as a welcomed sign that the Government is of the opinion that the highways are necessary to the prosecution of the war, and that new construction is advisable even though the railroads will be forced to carry the burden of the extra traffic, and in spite of the fact that the factories building road machinery might be utilized in the making of munitions.

A resumé of the reasons lying behind this declared attitude of the Government may be interesting and will certainly illuminate the questions of just what part the building of highways and the prosperity of the industries connected with such work has to do with the success of our efforts to bring victory to the banners of the allies. These reasons have generally been condensed into the mere statement that much of the freight congestion with which we are burdened would be lessened if our network of roads were more complete and maintained in a more perfect manner. This is far from the full explanation of the situation, leaving out of account many elements which are as vital as the commonly accepted view and which are in many ways far more cogent and far-reaching.

The classic instance of the use being made of the Cleveland-Akron route is becoming a trifle stale. As an example it is useful, but as a summation of the value of good roads it fails to consider many of the exigencies which the war has forced us to take into account. It fails because it is not even suggestive of the value that good urban streets may have, due to their ability to extend the limits of terminal yards, in allowing trucks to pick up freight at remote switches and deliver it to the store door. When this is taken into account, it is obvious that many of the artificial commercial limitations that we have grown accustomed to will vanish, making shipper and receiver aware of a facility they had not before suspected.

Of course the various state highway officials should not underweigh the fact that new construction practically ruins the value of the route upon which work is being done. In order to avoid this it will be necessary to make a careful study of all available routes in order that new work will interfere the least with such use as is being made at the present time of the roads already in existence. However, this should not be a difficult matter to determine.

Nor should it be forgotten that the scarcity of labor at many points is purely local. Secretary Wilson, of the Department of Labor, has assured us, in a way that does not admit of denial, that there is an adequate labor supply, but places a strong accent on the fact that the matter is one of distribution. Once the truth of this is admitted, it will be seen that our problem at the present moment is to keep all labor occupied at its present tasks until such a time as it is possible to determine where it can be better utilized. Suddenly to cease the construction of roads with the intimation that this order would continue until the close of the war would mean the shutting down of many dependent industries. The result of such an action would be calamitous. Even at the present moment the attitude of labor is none too favorable, and to throw out of work the thousands of skilled mechanics employed in the manufacture of road-building machinery would mean an unsettlement of conditions which would make it difficult to return to normal.

Another factor which is ordinarily overlooked is the 80,000 enemy aliens employed in munitions industries at Cleveland—to cite only one instance. The simple remedy to a situation such as this is to give them employment—under guard, if necessary—on road work, in plants manufacturing paving brick, cement or drain tile, or in quarries where their activities would not interfere directly with the manufacture of materials whose delay in delivery would be an irreparable loss. In work of the sort mentioned there would be but little incentive to destruction, and it is probable that no trouble would be experienced. Labor taken from munition plants and sequestered in work remote from direct connection with the war could be replaced with the more skilled labor which could be withdrawn from these last-mentioned industries.

Nor must it be overlooked or underweighted that the ports are at present overcrowded with munitions for which there are no bottoms. To concentrate blindly on the manufacture of war materials will prove to be an

unwise policy, and hardly calculated to be of any great help in the present crisis.

Without a question the employment of convict labor on highway construction not only is an economy in times of normal prices, but is in line with the most advanced theory of penologists. The main opposition to large-scale experiments in this direction has come from free labor. At the present moment free labor is in such demand that no trouble is to be anticipated, and the experiment can be tried out in a manner which will demonstrate, once and for all, its true value. Taken in connection with enemy alien labor, enough human energy will be available not only to provide roads absolutely needed at the present moment, but to bring our transportation system up to the pitch of efficiency which will be demanded by the post-war certainty of an intensified, international industrial competition.

In conclusion, it is well to remember that many industries which are manufacturing munitions produce, as byproducts, materials which are employed in the construction of the modern highway. If the market for these byproducts is wiped out, the Government must pay higher prices for certain of the materials it needs. As an example of this, toluol and carbolic acid are produced from the distillation of coal tar, the residue of which is the pitch from which so many of the most successful roads are constructed. To a large extent asphalt is the residue from the process by which gasoline is recovered—and while motor cars of the pleasure type can be dispensed with or used to a less extent, it has been found impossible to use any other fuel than gasoline in airplane engines.

Further Shortsightedness Regarding Engineering Education

THE Federal Board for Vocational Education has asked the engineering schools to terminate their present year on April 30 and to devote their equipment and instructional forces until Oct. 1 to the work of training artisans. In normal times, this would mean about two-months' curtailment of the school year. With a great many schools now, however, such a procedure would delay by five months the finishing of all engineering students other than the seniors. Recognizing the Government's need for trained engineers, these colleges are planning to run continuously, thus permitting the four-years' instruction to be compressed within three years. Instead of asking these colleges to depart from this intensive educational plan, it should be the work of some Government agency to urge the schools which have not adopted it to operate without the summer intermission.

If the federal board were able to show that it had exhausted all other means of training the necessary artisans, the engineering profession and the engineering colleges might quickly acquiesce in the proposed scheme. In New York City, at least, the available machinery for the training of artisans has not been exhausted, and unless the board can show that the situation is different in other cities it will with difficulty persuade the engineering profession and the engineering colleges that the intensive training of young men for higher technical work should be curtailed by using the college equipment for five months for an entirely different purpose.

Manifestly, the equipment and organizing ability of the big engineering schools is most attractive to a board casting about for the easiest way to accomplish a big task. If the schools were to be idle, or were not to be devoted to the fulfillment of an urgent war demand, no one would protest against immediate granting of the board's request. As it is, we trust that every engineering society in the country will oppose the plan most vigorously and continue such opposition until the federal board can demonstrate the absolute necessity of the course it has proposed.

Organization To Win the War

THE American people have been spurred on in their work of war preparation during the past year by various slogans. They have been told that "Food will win the war," that "Ships will win the war," that "Bonds will win the war." The revelations made in the investigation by the Senate Committee on Military Affairs during the past weeks prove that above and beyond any of these great needs is the need of "Organization to win the war."

The United States is by far the greatest industrial nation in the world. It has the men; it has the money; it has unlimited raw materials; it has the skill and brains and intelligence and experience necessary to bring all these great forces into harmonious operation to wage effective warfare. The American people have expected and the world has expected that the vast potential power of the United States would be organized for the world conflict with a promptness and thoroughness commensurate with America's reputation for business ability.

Of course it has been well understood that there were many difficulties to overcome, and that time was necessary to create great organizations to carry on the work; but millions of patriotic Americans have thrown every ounce of strength they possessed into war work, and there has been an optimistic belief that all this vast energy and enthusiasm was being efficiently directed and coördinated.

That optimism is at an end. The country is now face to face with the true situation. Senator Chamberlain, chairman of the Senate military committee, at a public meeting in New York on Jan. 19, said: "The military establishment of the United States has fallen down. There is no use in being optimistic about a thing that does not exist. It has almost stopped functioning, my friends. Why? Because of inefficiency in every bureau, in every department of the Government of the United States. America has been groping in the dark for ten months, with able hands but with no head responsible for a war program."

An attempt has been made to break the force of the Senate committee's investigation with the plea that the task of war preparation was so enormous that many blunders were inevitable and that those in charge did as well as anyone could have done. That excuse becomes invalid as one studies the detailed testimony before the Senate committee. Further, that testimony only served to confirm and make public the knowledge possessed by hundreds of business men, manufacturers,

engineers and contractors who have had direct experience of governmental methods during the past year. The public knows, too, that the men who are in the camps have lacked clothing, equipment and arms and that for a long time to come the United States will be unable to supply its troops with artillery, the first essential of present-day warfare.

There is no possible way of making up the time that has been lost. In the present urgent crisis, little time can be given, even, to fixing responsibility for the blunders of the past. Attention is properly concentrated now on the question, how can the present organization—such as it is—be remodeled into an organization competent to utilize the productive forces of America in the broadest way? A bill has been prepared by the Senate military committee, creating a war cabinet of three civilians, to be appointed by the President, and to be men "of demonstrated ability." This war cabinet would have the broad task of planning all operations in connection with the war and seeing to it that interference does not occur between different departments and bureaus. A bill to create a director of munitions, to have charge of the purchase and furnishing of all war supplies, has also been introduced.

The need of somebody with the ability and the authority to plan intelligently and direct in a broad way all the various fields of war effort has long been obvious to every keen observer at Washington. Such a body could not and should not supersede the present organizations in charge of different departments and bureaus, but it should discharge the duties as commander-in-chief of the armed forces of the United States which the Constitution lays upon the President and which he is actually able to discharge in theory only. It could and should, also, supervise and oversee the work of different departments, as the President is personally unable to do, and it should have authority to root out inefficiency and incompetency wherever found, and to inaugurate and compel a go-ahead policy all along the line.

The makeshift organizations with which the Government has been attempting to operate are so obviously ineffective that their failure could have been and in fact was freely predicted months ago. For example, the Administration attempted to secure the aid of experienced business men by creating boards and commissions and committees with merely advisory powers, or with an uncertain division of authority between these bodies and the executive officers with which they are associated. It has relied on the patriotism of these business men to contribute their own services gratis and pay their own expenses, and at one period, even, the expense of carrying on the Government's business. The resulting conflict of authority, friction, confusion and delays which have occurred are what such division of responsibility was bound to produce.

The Government ought, indeed, to summon to its tasks the ablest business men, executives and administrators that can be found, nor should the selection be confined to men of such wealth that they can afford to work for the Government without compensation. Further, these men should be given authority as executives and not as mere advisers, nor should their work be hampered by the official red tape and routine that has so long thwarted able military officers.

The creation of such a war cabinet as the Senate committee proposes is no reflection whatever upon President Wilson nor indeed upon members of his Cabinet. Even under peace conditions these executives have more than they can properly perform. To deal with the huge task of planning and carrying on the war deserves all the strength and energy of three of the ablest men that can be found.

Admittedly, we have been far from attaining efficiency in our governmental operations in time of peace, but we must nevertheless strive to attain it by every means possible in the present emergency, or risk the loss of the cause to which we are committed.

Store-Door Deliveries as a Remedy for Terminal Congestion

THE Highways Transport Committee of the Council of National Defense came before the New York Highway Traffic Association with a clean-cut, precise scheme for the amelioration of the terminal freight congestion existing in that city. Represented by its chairman, Roy D. Chapin, the board attempted to make clear the situation as it existed and to point out in a few words the necessity for a remedy, which to them seemed to lie in a pooling of trucking facilities. They claimed no especial novelty for the plan, mentioning, in fact, that in England no other scheme than "store-door deliveries" was considered practicable or even tolerated under present conditions. As any one who is at all familiar with such proceedings might have expected, their proposal was greeted not with a broad appreciation of its basic merits, but with innumerable objections on the part of this or that interest whose normal method of doing business would be slightly disarranged.

But these objectors, though loud of voice and many in number, all failed to see that the present situation is not one in which individual convenience can be considered, but that rather the point is whether it is not better to put up with a few inconveniences than to be put out of business. They have become so accustomed to doing their various tasks in a certain routine manner that their facility, one is bound to suspect, has become part of their stock in trade—a circumstance that is as essential to their continued success as the actual brains and energy with which they attack new problems. They have taken so many years in learning just how to expedite shipments in the present manner that they count this knowledge as commercial property.

But, unfortunately for these vain protestors, conditions have changed. When only 10% of the time of a freight car is consumed in the actual process of traveling from one point to another, the place to look when seeking efficiency in our transportation system must be at the terminals where much of the 90% is frittered away. When, also, the accustomed methods have been shown to be at fault, attention should be directed not at criticism of proposals that promise relief, but at the devising of better and more efficient plans.

Presumably this attitude of the stand-patter is human and forgivable, but it is to be hoped that the board will not be swayed by the number and noise of their opponents, but only yield ground before a plan so comprehensive and superior that its advantages will be recognized by everyone.

Pneumatic Mixer Train on Mount Royal Tunnel

Keeping Machines Close to Forms Found To Give Best Results After Trying Several Methods in Lining 14,000-Foot Bore

By F. C. K. Stuart
Principal Assistant Engineer, Mount Royal Tunnel and Terminal Co., Ltd., Montreal, Que.

THE BEST results in placing 64,040 cu.yd. of concrete by the pneumatic method in lining the Mount Royal tunnel were obtained by keeping the mixing plant close to the forms. This eliminated trouble with no plugging the line and made it possible to operate with less compressed air. The plan was finally developed to the point of building a plant on cars which could be moved as the work progressed, and in which the mixer was charged by a skip loaded from a small bin, which in turn was filled by belt conveyors passing beneath bins, mounted on the train, into which the

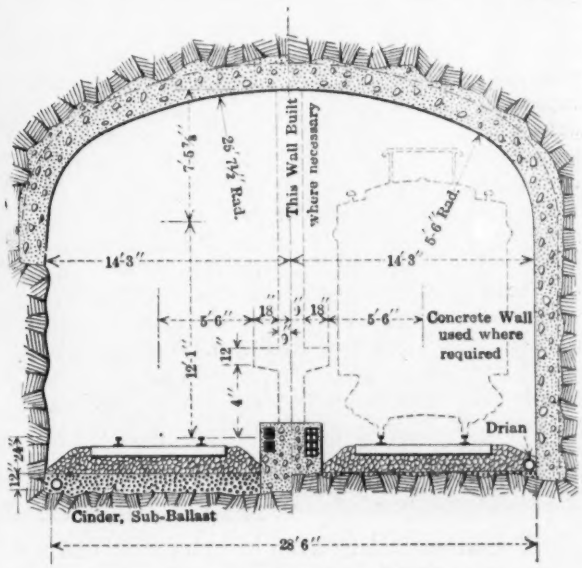
FIRST PLANT WAS STATIONARY

tunnel cars were dumped. These cars were hauled up an incline to the top of the train. This plant, which placed more than 37,000 yd. of concrete in 8 months with 7 sets of forms, not only reduced the delays due to plugs, but effected such a saving in wear on the pipe that it was possible to finish the work without purchasing a large extra quantity.

The pneumatic method was used in placing the greater part of the lining of the tunnel, the work being started in a small way to discover if the system were really economical and could be depended on to work continuously at a fair speed. It was realized that if such results could be obtained, the advantages of the pneumatic over old methods would be considerable. There were two sections of the tunnel to be concreted. In the larger section, which extended east from the west portal for 13,200 ft., the rock was all excavated and trimmed ahead of the concrete work, while in the smaller, which was only 1200 ft. long, the rock was so bad that it had to be taken out in small sections and the concrete placed immediately.

Generally speaking, in the larger section, where the rock sides were sufficiently solid, a hitch, shown on the drawing, was blasted from 3 to 8 ft. below the springing line and the sidewalls placed on this hitch. Where this could not be done the sidewalls were carried down to the floor of the tunnel. In the smaller length, where it was necessary to excavate the upper part of the tunnel and line it before removing the bench, sidewalls 3 or 4 ft. in height were placed directly on the bench. After the roof lining was completed the remaining excavation was carried on very carefully. In spite of this, the rock sidewalls proved so poor that concrete walls had to be put in down to subgrade.

The forms were wooden construction with steel skin plates for the arch form, which was not collapsible. In the longer section of the tunnel they were mounted on carriages running on double-flange wheels with sidewall forms hung from the same carriage. In the short section the arch forms traveled by means of rollers



LINING RESTS ON HITCH IN SIDE WALLS

on skids and the sidewall forms were built after the arch form was set. The forms were designed so that they could be used in sections that were multiples of 5 ft. In general 30-ft. forms were used in the large section and from 5 to 15-ft. lengths in the short.

The company was operating a large crusher plant at the west portal of the tunnel, but this plant was about 16 ft. above the level of the approach cut to the portal and 600 ft. distant. Consequently, additional bins for sand and stone had to be built in the cut

so that the material trains could be loaded in the shortest possible time. The bins were filled from an overhead standard-gage track that connected with the track under the crusher plant. The bins in the cut discharged by swinging gates into the 3-ft. gage tunnel cars directly beneath. All the track in the tunnel was of this gage. Thirty of the tunnel muck cars were converted from end to center dump for use in the material trains. These trains were hauled by standard 10-ton trolley mine locomotives.

In all, three stationary pneumatic plants and one mounted on wheels were used during the course of the work. The first plant was more or less of a crude affair and combined the ideas of the company's engineers and those of J. H. MacMichael of Chicago, who supplied the mixers. The sole idea at first was to keep the mixer supplied with material, as the necessity for a plant that could be easily and quickly moved was not appreciated until later. The first plant was set up on the south side of the tunnel, about 400 ft. east of the first form inside the west portal. This form traveled toward the plant and another was set up directly east

LAST PLANT, MOUNTED ON CARS, KEPT CLOSE TO WORK AND MADE BEST USE OF AIR PRESSURE

of it to travel away from the plant in order to determine how far the concrete could be shot. The mixer was rated at ½-yd. capacity, but was expected to use a two-bag batch of 1:2½:4½ concrete. It was set up as low as possible, the discharge pipe at the bottom resting on the tunnel subgrade. Directly above the mixer was the batch hopper, discharging by a single gate into the mixer, and above this hopper were small storage bins as large as the roof of the tunnel would permit. The sand and stone were supplied to these bins by two bucket elevators fed from two boots under a raised track. The cement was carried up to a platform at the level of the top of the batch hopper by a belt conveyor.

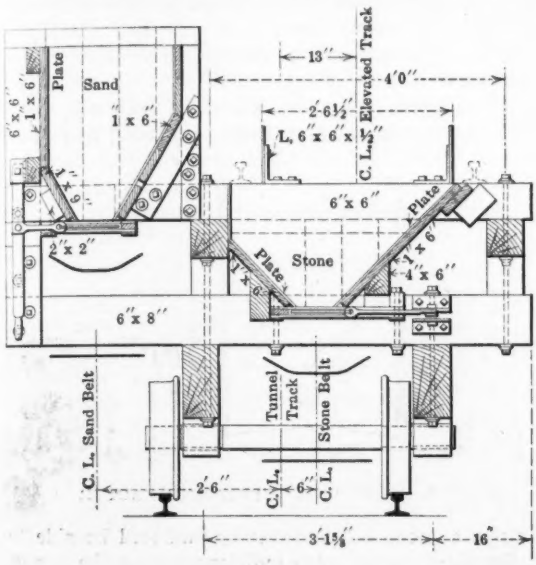
The horizontal discharge pipe, laid directly on the floor of the tunnel, was not fastened down. It was connected to the vertical pipe on the form by two 45-deg. 30-in. radius carbon steel elbows. The vertical pipe was fastened to the bottom chord of the arch form by chains and stiffened by a long knee-brace to the horizontal pipe. At the top were two more 45-deg. elbows to carry the concrete horizontally into the form. The joint between the top elbows and the vertical pipe was made to swivel, so that concrete could be directed to any place in the form. The concrete was carried as far back as desired by using nipples from 2 to 8 ft. long bolted to the last elbow.

First the sidewalls were built up as evenly as possible until the concrete was a foot below the top of the arch form. The mix was then dried a good deal and the arch built up from the back of the form. With a good deflector on the end of the discharge nipple and a proper mixture the concrete could be placed in almost any spot desired. Occasionally a little shoveling was necessary to fill up some awkward place. The form was bulkheaded except for about 13 ft. at the top in front, where the pipe went in. This space was bulkheaded with sand bags as the arch was built up.

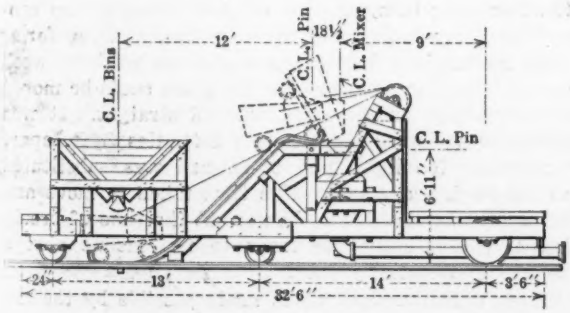
After a good deal of experimenting with the first plant it could be depended on to shoot a one-bag batch and very occasionally a two-bag batch. The latter generally caused a plug in the pipe. The trouble was that the single gate from the batch hopper allowed no control of the manner in which the material entered

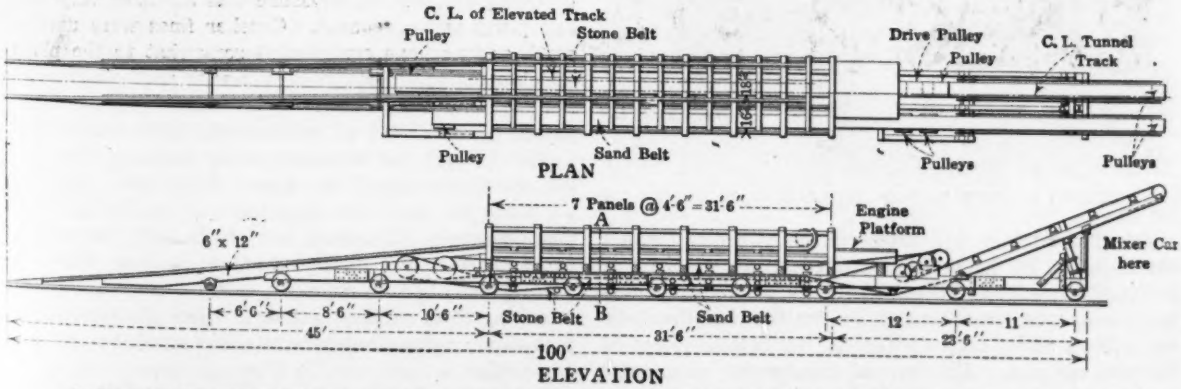
the mixer, and the water-measuring device also contributed to the difficulty because it was not possible to discharge water into the mixer exactly with the material, nor to properly control the duration of flow.

Work in the shorter section of the tunnel had to be started before the first plant had finished the work to be done at its first set-up. The shorter section had to be lined more slowly, so that a new type of plant was designed without any bins over the mixer, thus doing away with all the elevators and conveyors and making the plant much more portable. This mixer was rated at ¼ yd., but all calculations were based on a one-bag batch. The mixer was charged by means of a small shuttle car with a separate partition for sand and stone. This car was moved up and down from beneath the material track to dumping position over the mixer by a single-drum hoisting engine. The discharge end of the car was hooded, and the partition made movable so that the flow of sand and stone could be regulated and the aggregates mixed as they were discharged into the mixer. The car was loaded from two small bins built into the trestle that carried the material trains. The cement was brought in on the same track as the other materials and was unloaded and stored on a platform level with the top of the mixer. From here it was fed as required by means of a short chute into the shuttle car. After properly adjusting the partition in the shuttle car and determining the water feed, the second plant was found to be very successful. The mixer could be run steadily at the rate of two batches a minute provided the material supply could be maintained. This, however, was difficult to accomplish because the haul was two miles in from the crusher plant. Due to the care taken in putting the aggregates into the mixer there were remarkably few plugs in the pipe. The sand, stone and cement were roughly mixed together on entering the machine to give the best results, and the water started to flow an instant ahead of material, continuing in a steady stream until a few seconds after the charge was in the mixer.



SECTION A-B





CARS RAN UP ON ELEVATED TRACK, SIDE DUMP DISCHARGING SAND AND BOTTOM DUMP STONE INTO BINS FROM WHICH TWO CONVEYORS TOOK MATERIAL TO HOPPER OR MIXER; CAR WHICH LOADED CHARGING SKIP

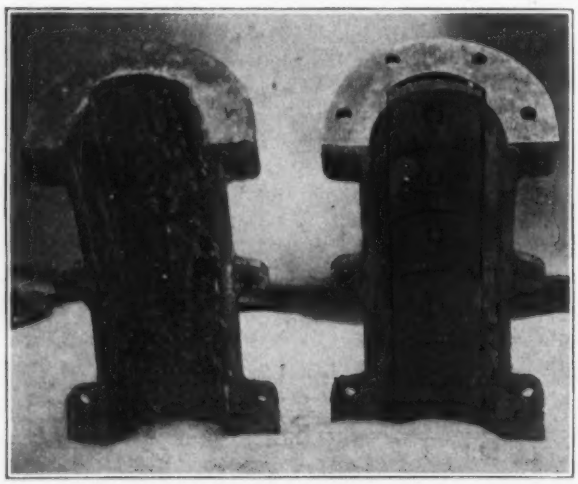
employed in mixing and placing concrete was seven men on the mixer plant, including a hoist runner and the mixer operator, three men on the forms, and part of the time two carpenter helpers looking after leaks in the forms.

The maximum distance between the mixer and the forms of this plant was 1200 ft. This occurred in concreting the section to which the mixer plant was to be moved. Except for this one case, the distance concrete was shot was generally not over 600 ft.

In January, 1916, it was realized that if the work was continued in this way all the pipe on the job would be worn out before completing the lining. The difficulty in maintaining sufficient air pressure for the long shots was expected to increase rapidly as the work advanced further and further from the compressor plant. The remedy for both these difficulties was to build a mixer plant on wheels that could be moved from one form to another, making it possible to operate with a maximum length of pipe between 60 and 100 ft., and with a great saving in compressed air and increased speed of operation. The time taken for one batch to travel out of the mixer, down 1200 ft. of pipe and into the form varied from 40 sec. to 1 min.

The design of such a plant presented numerous difficulties, especially as it was thought best to build it for 3-ft. gage track so that the plant itself could travel on the material track laid in the center of the tunnel. The height of the plant was governed by the headroom under the forms, which was about 12 ft. from the top of rail.

The mixing plant designed to meet these conditions is shown in the drawings and photographs, and incorporates the ideas that worked well in the second and third plants. The hoist for the shuttle car is not shown in the drawing, but was placed on the platform to the

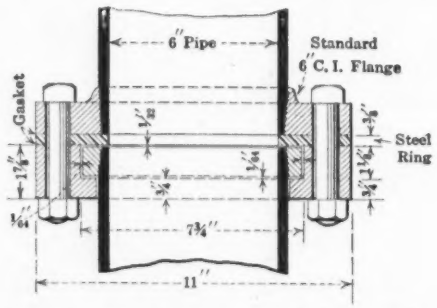


LINING PLATES SAVED REPLACEMENT TIME

right of the mixer. In front of the mixer car was a car about 18 ft. long which carried an air receiver of 158 cu.ft. capacity and the discharge pipe. This pipe was hung below the receiver car, giving two lengths from the bottom elbow of the mixer to the bottom elbow of the vertical pipe. This proved insufficient, so another length of pipe was added which was carried on a pony truck fastened ahead of the receiver car.

The photograph shows the plant in the tunnel with the mixer car in the left foreground. Behind the mixer car is the inclined conveyor car, so called for want of a better name. The material trains were run up this incline into the top of the conveyor car, the stone cars, being center dump, and the sand cars side dump, discharging into small boots with sliding gates from which the material was fed to a pair of belt conveyors. These conveyors carried the stone and sand to the small bins on the mixer car. The drawing shows a section through one of the six boots and a side elevation of the car. Cement was unloaded and stored on the small platforms above the ends of the belt conveyors and dumped through a small chute into the shuttle car as required.

The plant worked very well, the chief drawback being the stub end to the material track. However, there was



SWIVEL JOINT WAS IMPORTANT FACTOR

no way to overcome this difficulty and still be able to work the plant under any conditions among the forms.

Although it was planned to space the forms about 200 ft. apart and move them all in the same direction, the trimming being carried on just ahead of the concreting delayed the work more or less, and the forms were moved in a haphazard way from week to week as the trimming progressed. The plant could be moved fairly readily, as the track was all straight. It was found that the 40-lb. rail with 5-ft. ties 3 ft. apart was really too light, and 60-lb. rail was substituted as the work progressed. The time taken to move and set up averaged about 2½ hours, but the time of breaking and connecting the track to the incline always seemed unnecessarily long.

Even with the short shots made possible by the use of this plant, the air pressure was at times very poor and plugs were frequent. Crusher fines were used as sand, and perhaps contributed somewhat to the plugs, which occasionally occurred even with good air pressure and a reliable operator. The traveling mixer plant placed about 37,265 yd. of concrete in 8 months with 7 sets of forms, the best month being October, when 5811 yd. were placed, and the lowest May, when but 3410 yd. were put in. This was the first month the plant was operated. It worked two shifts, and the average force for one shift in the tunnel on concrete work was a foreman, a mixer operator, a hoist runner, thirteen laborers, three dinkey runners, three brakemen, one pipe fitter and one handy man. The carpenters worked one shift.

Generally speaking, the performance of the mixers was satisfactory after it was realized that though the

machine was apparently simple there were a few small mechanical details which were absolutely essential to economical and fairly continuous operation. The chief of these were the swivel joint just below the top elbow and the use of reliable elbows. The swivel joint itself is very simple, and is shown in one of the drawings. The elbow at the bottom of the mixer was also made so that it swung in any direction, but this feature was not so important after the traveling plant was adopted.

The pipe used was 8-in. mild steel that had been employed previously as an air line. This pipe had plain ends for Dresser joints, and these joints were used. However, they were not considered to have enough strength to resist the pull of the concrete through the pipe, and were reinforced by fastening two angles to each end of each section of the pipe and connecting angles by a pair of ¾-in. machine bolts. At the commencement of the work ordinary cast steel elbows were supplied by the agent of the firm which furnished the mixers. They proved very unreliable, one elbow standing up for 1000 yd. and another one for less than 100 yd. When a blowout occurred it was sometimes possible to put on a patch to last until the form was finished, but in a great many cases it was necessary to take down the elbow and replace it, wasting a good deal of time.

The first improvement made was to get some split elbows, the idea being that as the backs alone wore out they could be replaced with little more than half the trouble required in removing the whole elbow. Four split elbows of manganese steel were ordered for trial, but it was found that under the same conditions the manganese steel only wore 50% longer, while the cost was four times that of the old carbon steel elbows. The old elbows wore out only in one place, so that it was believed the most economical proposition would be to split a few carbon steel elbows with reliable backs, and use reliners consisting of blocks that could be replaced as soon as worn out, as shown in one of the photographs. With an elbow of this type and with proper inspection there should be no delays in concrete work of this character. Fifteen 45-deg. elbows of this type were ordered and reliners of various material, including cast iron, cast steel, manganese steel and ferralun, were procured for trial. Pure rubber in the shape of old sections of motor truck tires was tried, but could not be held in place in the elbow. The most economical lining was found to be cast iron, though ferralun outlasted all the other materials.

This elbow was a great improvement and was used for the rest of the job. It gave very satisfactory service, though after being relined several times the block reliners had a tendency to blow out owing to wear of the elbow itself alongside the liners. When the elbow reached this stage a forged reliner in one piece was put in to fill up all the worn spots. This type of elbow has since been patented and considerably improved. It is now being experimented with on other work.

The pipe wear was considerable, but no figures are available as to the amount actually destroyed. Most of the wear occurred at the ends, and when a length was worn through the ends were cut off and the pipe used again until entirely worn out. The reinforced Dresser joints gave satisfactory service, but there were occasional blowouts due to bad plugs. Where the end of the horizontal pipe connected to the mixer elbow and to the elbow at the bottom of the vertical pipe, a flange was screwed on the pipe.

The compressor plants available had a capacity far above the rated requirements for the mixers, but unfortunately there were so many drills and pumps run from the same air line that it was impossible to tell exactly the amount of air that the mixers used. The quantity was above 1100-cu.ft. per minute, and the mixer would not operate without danger of plugging if the pressure dropped below 70 lb.

The work was designed and executed by the Mount Royal Tunnel and Terminal Co., for which S. P. Brown was chief engineer; W. C. Lancaster, electrical and mechanical engineer; Richard Byers, general superintendent; R. T. Gent, master mechanic and electrician; W. E. Joyce, engineer of design, and the writer, principal assistant engineer.

Use of Self-Healing Coating on New York Central Bridges

PLASTIC "self-healing" coating has been used for the protection of bridge steel over tracks by the New York Central R.R. for five years past. This is the material now being used by the Santa Fe, as reported on p. 888, Nov. 8, 1917. The first application on the New York Central was made in 1912, we are informed by A. W. Carpenter, assistant valuation engineer. Prior to this, however, test exposures had been made in a tunnel. After four years exposure, full protection was still obtained; but, as the specimens were hung along the side of the tunnel, they were not subjected to the direct action of the locomotive blast.

Since 1912 the material has been used quite extensively by the maintenance-of-way department of the company for protecting iron and steel structures over steam-operated tracks, and for protecting the exposed surfaces of steel floor troughs and floor plates.

From some divisions of the railroad good results are reported, and the use of this coating has been continued from year to year. During the past year one particular division applied the coating to no less than twelve steel structures. On one division, however, the material failed to protect the steel against locomotive blast and gases on three structures located over tracks where the clearance above rails averaged 16 to 19 ft. It is believed that this low height is the cause of the failure of the material, as most of the overhead structures on other divisions where favorable results were obtained have clearances of 21 to 22 ft.

Four Municipal Offices Combined in One

Following a legislative amendment to the charter of Middletown, Conn., the offices of director of public works, city engineer, superintendent of streets and sewers, and building inspector have been combined in one under the title of director of public works. The director is continued in service until dismissed by a two-thirds vote of the common council. The office is now filled by C. A. Campbell, who had served for a short time as city engineer and building inspector.

Engineering Council Urges Federal Water-Power Legislation

Cheap and Self-Renewing Power, with Resultant Conservation of Coal, More Important Than Minute Control of Profits, Calvert Townley Tells National Chamber of Commerce

THE Chamber of Commerce of the United States recently invited the Engineering Council to present a statement before its special Water-Power Committee, which is considering the subject of needed Federal legislation for water-power development. The Council delegated Calvert Townley, M. Inst. Elec. E., one of its members, to appear before the Committee as representing the Council. The following is taken from Mr. Townley's statement:

It is my pleasant duty to appear before you by vote of the executive committee of the Engineering Council, in response to your kind invitation of Jan. 10. As the Engineering Council is empowered to speak for the American Society of Civil Engineers, the American Institute of Mining Engineers, the American Society of Mechanical Engineers and the American Institute of Electrical Engineers on matters of common concern to all of these bodies, the Engineering Council's official utterances concern only such underlying principles and economic facts as are indorsed by all engineers and beyond the field of controversy. These societies are scientific and professional. They, therefore, refrain from expressing views on legal, political and commercial questions except when such are closely linked with essential engineering facts.

It has been estimated by a careful engineer that in 1911 there was over 26,000,000 steam engine horsepower capacity in use (including railroad locomotives), in the United States. The aggregate water horsepower, both developed and undeveloped, has been computed as around 60,000,000. Of this latter the U. S. census of 1912 gives 4,870,000 as developed, and in a report of January, 1916, the Secretary of Agriculture estimated this total to have been increased to 6,500,000. Some of the undeveloped power sites are too remote from any market to be now utilized, and an uncertain number are not commercial prospects; but even so it is clear that the possibilities of additional development are very great.

High Cost of Water Power

There are two fundamental causes which have militated against the substitution of hydro-electric for steam-electric power. One is economic and permanent; the other is statutory and therefore subject to modification. The economic and permanent reason is high cost of development, due to natural conditions. Electric power generated by falling water is inferior to that generated by steam in every particular except cost and, therefore, water-driven service must be cheaper than steam-driven in order to justify its existence. The price for service depends primarily on cost, and cost divides itself naturally into two main items—namely, operation (including maintenance) and fixed charges. As a hydro-electric plant consumes no fuel, its operating cost is less than that of an equivalent steam-driven plant. On the other hand, a steam plant costs usually only from one-fifth to one-half as much per unit of capacity as a hydro-electric plant, so the latter must carry very much heavier fixed charges.

This disability of water service is usually even greater than the ratio of the costs of two equivalent complete developments. A power enterprise seldom comes into being with a market for its entire ultimate output. Therefore, when steam is to be the motive power, only such capacity is installed as initial demands require, and the cost per unit is fairly proportional to that of the ultimate development. In a water development, on the contrary, a large part of the cost is for riparian rights, for the dam, impounding reservoir, flume, forebay, etc., and for the transmission right-of-way, towers, etc., which must be, at the start, provided in large part, and constructed for the complete installation. The obvious result is a greater fixed charge per unit of capacity and a higher cost per horsepower delivered for sale.

In forecasting the commercial prospects of a power enterprise, the possible market must be studied, and, of course, a sale price for power decided upon. As this price is controlled by the cost of similar service from other sources, usually from steam, and as it must be attractive from the start, the additional burden of fixed charges on the initial part of a hydro-electric installation frequently forces the sale of its power below cost. The projectors of the enterprise then must rely for success on a sufficient subsequent increase in their markets. The possibility of an incorrect forecast of the extent of such increase and of the time when it may come imposes a serious business hazard against water and in favor of steam.

Rising Cost of Coal Offset by Increased Efficiency of Steam Power

It has been frequently pointed out that as the nation's coal supply is depleted the cost of coal must rise, thus increasing the cost of steam-electric power as a competitor and raising the market value of hydro-electric power accordingly. The rising price of coal is a matter of record, but it is not so generally known that the improved efficiency of steam-producing machinery (boilers, engines, generators and auxiliaries) has more than kept pace, so that the net cost of producing electric power from coal has steadily declined. As applied to the pre-war period, it may be stated that over a period of ten years the cost of coal has risen on an average 1% per year, while the cost of electric power produced from coal has fallen on an average 2½% per year.

In addition to these facts—still referring to pre-war conditions—the cost of steam-electric generating equipment has been greatly reduced. This fact is due partly to the introduction and subsequent improvement of the steam turbine, and in part to the great increase in the size of the units now available. There is nothing to indicate that the limit of improvement in the design of steam prime movers has been reached or is even in

sight. It is, therefore, a reasonable assumption that further advances in the art will continue to occur and to cut down both the fixed charges and the operating cost of steam power as a competitor of water.

The largest modern steam turbine has now some 12 times the capacity which the largest reciprocating engine had 15 years ago. Stated in another way, the cost of a steam-electric plant per unit of capacity just before the war was about one-third what it was 15 years earlier, while the energy it produces per pound of coal has increased 50 per cent.

Obviously many water-power sites which 15 years ago might have been developed to sell energy in successful competition with steam at its cost then could not now be so developed, and in consequence their development is no longer commercially possible.

An Example of Steam Power Competition

The cost of producing power from either water or steam is a function of the load. Fixed charges remain practically unchanged in both instances whether the output in energy be large or small; but with a steam plant increased output means increased fuel consumption, while a water plant operates either with or without load with but little variation in expense. To illustrate by a concrete example representing not unusual conditions, suppose we assume a steam plant using 2½ lb. of coal per kilowatt-hour at a price of $3 per short ton and having a plant or output factor of 35%—that is to say, an output equal to 35% of its theoretical output if every unit were loaded to capacity 24 hours each day of the year. Under these assumptions the cost of fuel per unit of installed capacity per year would be $11.50, and if the other operating and maintenance charge be assumed to offset fairly those of a water installation of equivalent size, $11.50 represents the additional fixed charges which the hydro-electric plant could carry, and produce power at an equal cost. If therefore the fixed charges (interest, taxes, insurance and amortization) total 11.1½%, the hydro-electric investment per kilowatt capacity could exceed that of steam by $100.

This is not an abnormal excess. Many hydro-electric developments exceed the cost of equivalent steam-driven systems by much greater amounts, in which cases they become commercial prospects only if coal be more expensive per unit of output, or the plant factor be higher, or some other operating or maintenance condition be more favorable.

Further, as has been previously stated, hydro-electric power is inferior to steam-electric power. The reasons are elementary. Stream flow is subject to seasonal variation, and therefore to complete or partial interruption by drought in summer and by ice in winter. Floods are a menace. Long transmission lines may be broken by wind or sleet, or the service may be disarranged by lightning. The losses on such lines vary with load, and are frequently responsible for annoying pressure variations. For these and other reasons, hydro-electric power cannot prevail against steam competition at the same or a slightly lower price. It must be materially lower.

We do not mean to imply that water power may not be a commercially practicable competitor of steam. Many successful hydro-electric installations give substantial proof to the contrary. We do wish, however, to combat most emphatically the widely held but mistaken view that any water-driven plant will produce power at lower cost than steam can and that the margin is so large that investors generally are eagerly seeking a chance to put money into hydro-electric projects. The most careful investigation, frequently demanding substantial expenditure and the keenest scrutiny by experts, is needed to discriminate between worthy and commercially impracticable projects, and the difference is often so small that the imposition of even what seem to be minor burdens is sufficient to turn the scale in favor of steam and entirely prevent what might otherwise be a desirable hydro-electric development.

The second condition which vitally affects development is statutory. Of the estimated 55,000,000 undeveloped water horsepower in the entire country, approximately 40,000,000 is located in 13 Western states, where the Federal Government still owns 760,000,000 acres of land, or over two-thirds of the aggregate area. In order to develop power in that section it is therefore nearly always necessary to use some part of this public domain—if not for the dam site itself at least for flowage, for transmission right-of-way or for some other purpose. Existing law forbids such use except under permit issued by the Secretary of the Interior and revocable without cause, at any time, by himself or his successor in office. It was once believed that revocation would only follow gross abuse well established by evidence, but the drastic action of a one-time Secretary of the Interior some years ago disabused investors of this confidence and demonstrated by a sad object lesson the insecure tenure afforded by existing law. The unfortunate—almost disastrous—result has been practical stagnation in water-power development for many years.

Many available power sites not in the Western states, or not on the public domain, are on navigable streams. For each such project a special act of Congress is necessary. The difficulty of obtaining suitable rights by this means has been found so very great as largely to discourage, even if not to prevent entirely, the developments affected.

Pending Water Power Bills

The several remedial laws recently considered by Congress recognize the essential facts and agree that the remedy is a new law containing the following provisions, namely: An indeterminate permit irrevocable during 50 years, except for cause judicially determined, and continuing thereafter unless and until the Federal Government either renews its permit on mutually agreeable terms, or for itself or through a new permittee takes over at its fair value the hydraulic works and certain other parts of the development.

The Engineering Council does not consider itself expert in legal matters and will not undertake to discuss the relative merits of the different plans. It should be pointed out, however, that a hydro-electric enterprise being once successfully established, it is alike to the interest of the owners, of the Government and of the public that it should continue indefinitely without interruption. There is no economic reason to be served by a cessation, and the only reasons for providing a

legal means of recapturing the installation and the water rights are, first, to preserve an additional measure of Government control against possible abuse by the permittee, and, second, against a remote contingency which might make it desirable that the Government would want to use the power for some other purpose.

Difficulties in Provision for Recapture

A successful power enterprise at the end of 50 years will have multiplied the capacity of its initial installation many times, variously estimated at from five to twenty. In doing so it is almost certain that not only will the entire power available at the original site be fully developed, but other powers as well, which latter may or may not be dependent upon Government permits. Still further, in nearly all cases steam plants as well as water plants are necessary. These steam plants are necessary to supplement hydro-electric power at periods of low water and in case of interruption, as well as, in some instances, to provide increased capacity. In fact, modern practice is rapidly approaching the point of providing steam capacity equal to 100% of hydro-electric for the purposes stated. In any event, the growth of the enterprise over a term of years will be continuous and progressive. There will never come a time when it may be said to have been completed and subject to no further expansion. This continuing growth makes burdensome and usually abortive any attempt to amortize the investment, while the investment in other water powers or in steam plants or both, interconnected with and generally dependent for their economic operation on the original development, renders the right to recapture that development only very onerous and makes it one which constitutes a serious impediment to the free and full development of an enterprise otherwise most desirable from all standpoints.

With respect to power sites on the public domain and on navigable streams the Government is in the position of seeking to have its resources developed without assuming any business hazard and without contributing either capital or credit. It would be unfortunate, in the light of past experience, if any new laws which may be enacted should put the Government in the position of bargaining with capital and of offering just sufficient incentive not to induce capital to undertake the developments desired, thereby, while apparently providing a remedy, in reality insuring a continuance of the present undesirable condition.

Hydro-electric enterprises must compete with the demands of other industries for capital. Experience has shown that even without the imposition of additional financial burdens many of them are not sufficiently attractive to secure development, and as the attractive prospects grade by imperceptible degrees into the unattractive ones, it is perhaps self-evident that every additional burden, however small, transfers a percentage of such projects from commercial into uncommercial prospects.

It is our belief that the benefits afforded the communities served by cheap power, and to the nation by the conservation of coal resulting from the substitution of a self-renewing for a non-renewable natural resource, are far more valuable than is the exact solution of the question of restricting the returns to capital to their irreducible minimum.

Study Urged in Design of Small Coaling Stations

Storage Capacity, W. T. Krausch Says, Must Be Full Carload To Avoid Holding Cars—Various Types of Machinery in Use

ECONOMICAL operation of small coaling stations is a problem which needs more study in their design and equipment, according to a paper read recently before the Western Railway Club by W. T. Krausch, engineer of buildings of the Chicago, Burlington & Quincy R.R. Stations handling 10 to 30 tons per day were referred to particularly. While this amount is small, said Mr. Krausch, the receiving pocket and storage bin must have sufficient capacity for a full carload in order to avoid detaining cars for unloading. Thus economy in transporting and delivering coal involves high first cost of the coaling station, since the capacity must be greater than would be needed otherwise. This will result in a high cost of labor, unless the operator can be utilized to advantage on other work.

As to relative cost and capacity of unloading cars by dumping and shoveling, it is estimated that one man can unload a 50-ton drop-bottom car in about 30 minutes. But he can shovel coal out of a gondola car only at an average rate of 25 tons per 10-hour day. These estimates are based on run-of-mine bituminous coal.

For handling storage coal different methods are available, the selection depending largely upon the capacity and local conditions. Most coaling stations have elevated bins with gravity discharge. For direct loading of the bins or pockets by coal cars, the cars may be raised on incline trestles, the maximum grade being about 5% where they are pushed by locomotives, or 20 to 25% when they are handled by a cable and hoisting engine. The latter is the safer, involves less switching and requires less space.

Conveyors Used Mainly

More generally the coal is dumped from cars into a hopper beneath a track at the ground level and is transferred to the elevated bin by mechanical means. Bucket elevating conveyors, composed of endless chains of small buckets, are used largely and can be adapted to almost all conditions. The elevator may be of the continuous and overlapping bucket type, or of the pivoted bucket type. Both are run at slow speeds, the former on account of its great capacity and the latter on account of the methods of loading and dumping.

Belt conveyors have been used successfully in many plants. Coal unloaded from cars into a receiving hopper is fed by a loader to the belt, which elevates it to the storage bin. The belts may be of rubber or cotton, and the maximum inclination is about 30 degrees.

Elevators having one or two large buckets, of one-ton capacity or over, represent a recent type, which Mr. Krausch states is gradually coming into use on account of its simplicity and its low maintenance cost. In this case also the coal is delivered from cars to a track hopper. From this it is loaded automatically into the bucket, the feed being cut off when the charge is complete. The bucket is then raised and dumped. Two buckets may be worked together, one ascending while

the other descends. With the single-bucket arrangement the capacity of plant may be increased by adding separate units.

Power Plants Use Grab Buckets

A type of plant employed more at commercial plants and power houses than at railway coaling stations utilizes large clamshell buckets which are loaded in the track pit, raised in an elevator leg and then automatically locked to a trolley running on an inclined track leading over the storage bin. At railway terminals, locomotive cranes with grab buckets are sometimes employed to load the tenders with coal taken from a stock pile or directly from cars. When not engaged in coaling engines the crane can transfer coal from cars to storage bins, handle sand, load cinders into cars and do other work about the terminal.

Factors important in reducing the cost of operation and maintenance of coaling stations include the following: Selection of the type of station suited to the local requirements; use of self-cleaning cars; provision for emergency storage; reliability of mechanical equipment, with possible duplication of machinery where delays would be serious; fireproof construction of steel, reinforced-concrete or both in combination; fire protection for frame stations, with power plant built at a distance; minimum amount of switching by locomotives, using car-pullers to reduce this work; good labor and proper supervision of operation; careful maintenance and inspection, with provision for keeping or promptly ordering important repair parts.

Will Determine What Roads Should Receive Federal Aid

Office of Public Roads Sends Questionnaire to All State Highway Departments—Only Vitally Necessary Work Encouraged

UNDER a recent date L. W. Page, director of the Office of Public Roads and Rural Engineering, sent to all district engineers the following letter:

In line with a request made by the Secretary of the Treasury, Hon. William G. McAdoo, to the Secretary of Agriculture, it has been determined that, so far as it is practicable to do so, the Federal Aid funds shall be applied during the working season of 1918 only to the construction of such roads as are vitally necessary to improve the transportation system of the country, or to make feasible an increased output of important agricultural products.

You will, therefore, take up with the several state highway departments in your district the question of formulating a program for the expenditure of all such funds as are available for the working season of 1918 and such additional period as may be required. All projects whether approved or pending, and any additional projects desired by the state should be included. The state highway departments should be requested to conform as nearly as possible to the foregoing policy.

A supply of schedule forms indicating the information desired is sent you herewith for use by the highway departments in preparing their program. It is important that this information should be had *at the earliest possible moment* and you will render all possible assistance to the state highway departments in their preparation of the schedule.

A map or maps should be submitted bearing coördinating references to the statements made by the state highway officials in the schedule.

Accompanying this letter was a large form containing questions to be answered by the state highway departments. The information thus secured will be of immediate value. The questions are:

1. Location of road by county and termini
2. Local name of road
3. Length in miles to be improved
4. Present type of surface
5. Present condition
6. Proposed type of surface
7. Approximate total cost
8. Approximate amount of Federal aid desired
9. Materials to be hauled in by rail

   Kind of Material
   Approx. Miles Rail Haul
   Sources (Producing Territory)
   Approx. Tons Required
   Approx. Period of Delivery

10. Relation of proposed road to other important roads in affording needed transportation facilities
11. Volume and character of present traffic
12. Probable change and increase in traffic to follow construction
13. The definite purposes to be served by the proposed improvement
14. The possible bearing of the proposed improvement on the war situation
15. Probable effect of delay in construction to the 1919 working season or later
16. The relative numerical rank in order of importance of the proposed improvement
17. Further remarks by State Highway Department

Draglines Make Bridge Across Rio Grande

To place two 60-ton Bucyrus dragline excavators in position for beginning work on the west side of the Mesilla Valley of the Rio Grande U. S. Reclamation Service Project, it was necessary to cross the river. The bridges in the vicinity are too narrow and would sustain only 25% of the weight of these machines. It was necessary therefore, says the October *Reclamation Record*, to run them on their own caterpillar tractors from the railroad station across the river bed to the proposed ditch location. A runway down the bank was excavated to reach the river bottom. The first machine crossed the quicksand in 1½ days, utilizing platforms to distribute the weight and to prevent the sinking which would have occurred if they had not been used. The second machine crossed in half a day.

Although the Elephant Butte dam gates were closed, it was impossible to dry the river bed completely and some excavating and damming had to be done to turn the thread of the stream behind the machines.

J. L. Burkholder, who was transferred recently from the drainage work on the Boise Project to El Paso, supervised the arrangements for the crossing.

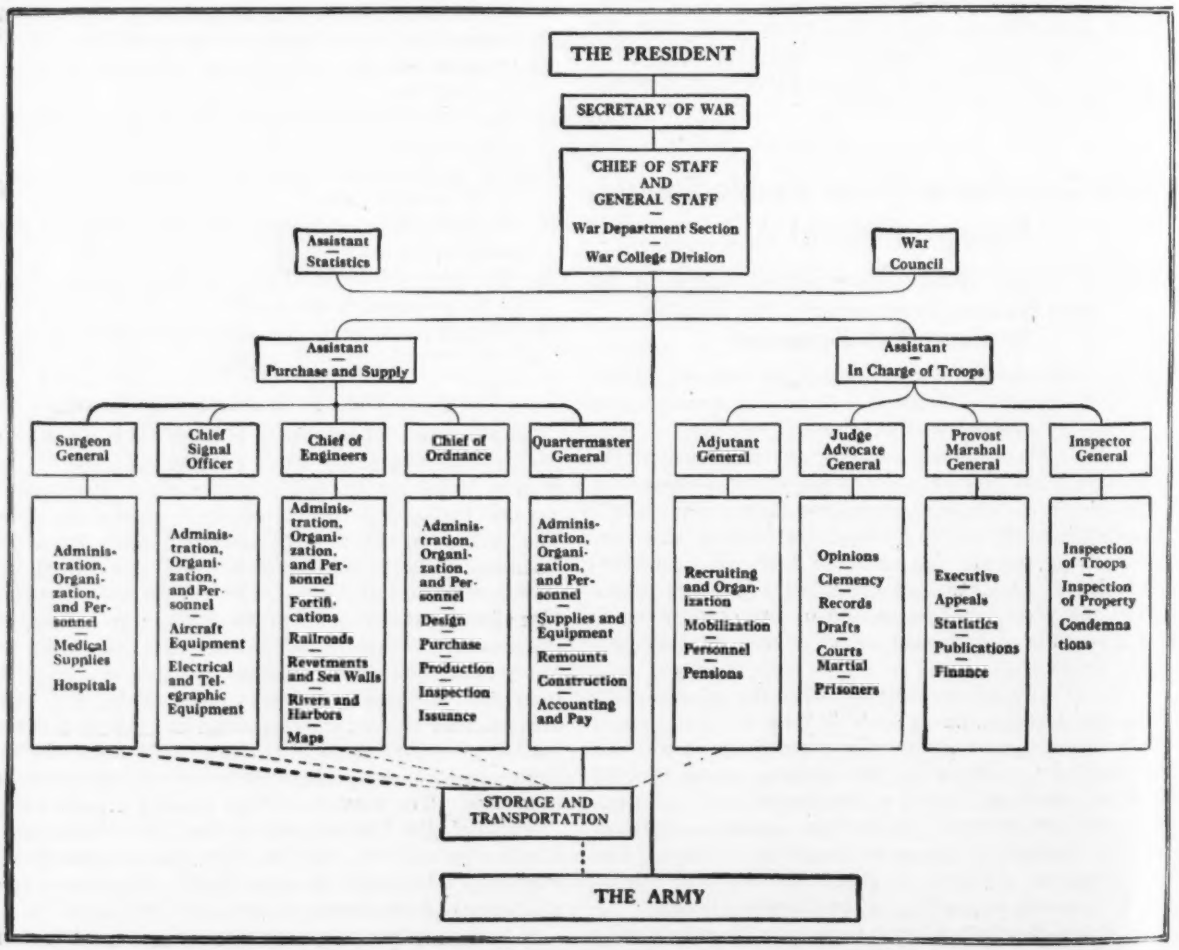
War Industries Board To Be Central Agency for Mobilizing Nation's Resources

Plan Outlined by Secretary Baker Coördinates Administration's Four Great Purchasing Branches, Utilizing Existing Machinery and Avoiding Disrupting Effect of Creation of Munitions Director

ON JAN. 12 Secretary Baker explained in considerable detail to the Senate Committee on Military Affairs the reasons for his personal objection at this time to the creation of a director of munitions to supervise all purchases of supplies of every sort for war purposes in this country. These reasons may be summarized briefly by the statement of opinion that the reorganization of the War Department and the War Industries Board will provide an entirely suitable agency for promptly and efficiently performing such work and should be tried before the present organization, now in process of remolding in the light of the experience of the administration in war work up to date, is thrown into inevitable confusion by drastic changes.

It was necessary at the beginning of American participation in the war to begin training immediately a great number of men to carry on the administrative and technical details of the department's work. No matter how these were ultimately grouped, they had to become familiar with their duties and with Government methods of work before they could render effective service. While this training was going on the reorganization of the department was being studied, and as army ordnance was in great demand this branch of the service was first changed.

It is a purely technical branch. Secretary Baker characterized it as a "manufacturing" branch, and the scheme of reorganization was developed with the help of men who have made a specialty of manufacturing organization. Formerly the work of the ordnance branch was subdivided according to products, such as small arms, but under the new system it is subdivided by functions, so that one branch will have charge of the technical details of design, another of purchase,



IN NEW ORGANIZATION OF WAR DEPARTMENT PURCHASE AND SUPPLY SECTION COÖRDINATES NEEDS OF FIVE MAIN BRANCHES OF DEPARTMENT

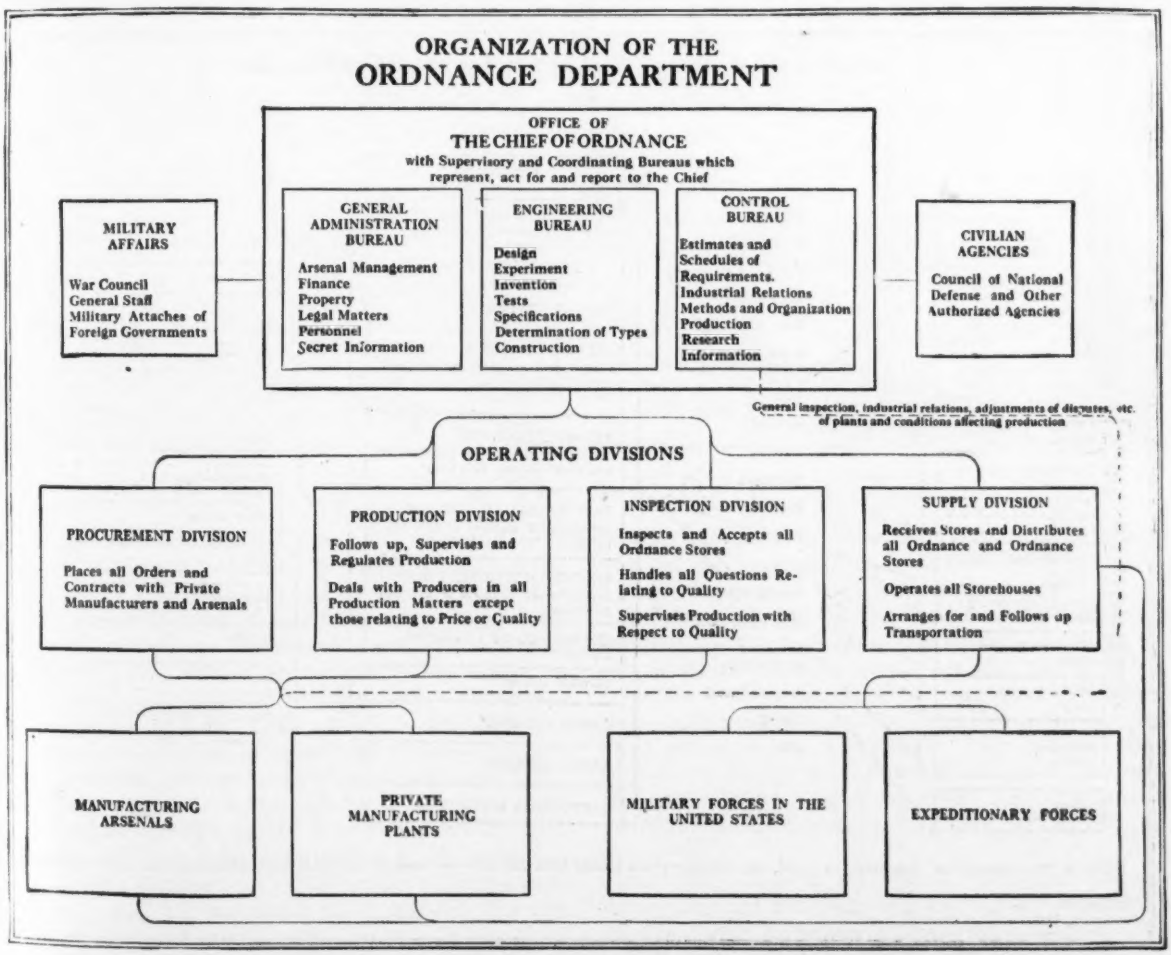
another of inspection and another of supplying the equipment when and where needed. This functionalizing of the ordnance branch is in harmony with the methods of organization now favored by a large number of the leading manufacturing corporations in the country. The men working under the old system of organization are having little difficulty in shifting into the new systems without interruption to their labors.

The quartermaster corps is now being reorganized in the same manner, and the high positions in it are being filled, as in the case of the ordnance branch, by civilians holding leading positions in the callings they have to carry on for the army.

Under the old scheme of organization there was an immense amount of detail which went from each branch of the department to the secretary's office. Under the new organization a very large part of this detail, which had to do with correlating the requirements for supplies for the different branches, goes directly to a central office. The ordnance, quartermaster, engineering, medical and aviation branches will purchase their supplies, as they have in the past, except that before contracts are signed they must have the approval of this central office, in order that one branch may not needlessly hinder the operations of another in the market, and other business reasons that need not be detailed here.

The War Department is not alone in making great drafts on the industries of the country. The Allies Purchasing Board, the Navy Department and the Shipping Board are similarly straining the resources of our manufacturers, and no legal remedy for this condition has been provided by Congress. But the four great purchasing agencies have agreed to joint action through the War Industries Board, which has been reorganized in order that it might do for all American munition manufacturers what the central bureau of the War Department does for its five great purchasing branches. The requirements of the four agencies are reported to a central committee, which is directly in touch with the manufacturing facilities of the country and knows not only how much work each factory is doing for the Government, but also how much it is doing for necessary civilian customers. It is this committee which passes on the priority to be given each of the orders. If its decisions are questioned, the appeal is made to the War Industries Board, which thus becomes arbiter of manufacturing priority in this country in every industry furnishing supplies for military purposes.

The committee has a further very important function which was explained by Secretary Baker as follows: Assume that General Pershing cables a requirement for 1000 guns. As his requisitions are not questioned, a



ORDNANCE DEPARTMENT NOW SUBDIVIDED BY FUNCTIONS, IN ACCORDANCE WITH GENERAL MANUFACTURING PRACTICE—QUARTERMASTER CORPS BEING SIMILARLY ORGANIZED

copy of the order would be sent at once to the ordnance branch of the War Department and another to the central committee of the War Industries Board. While the ordnance officials were preparing the plans and specifications the committee would ascertain what sources of raw materials could be used with the least interference to the manufacture of other necessary supplies, what forge shops could be utilized and what plants were available for producing the other parts of this order. As soon as word was received that the ordnance department was ready to buy these guns, the committee would notify the procurement division of the ordnance corps what parties should be invited to bid.

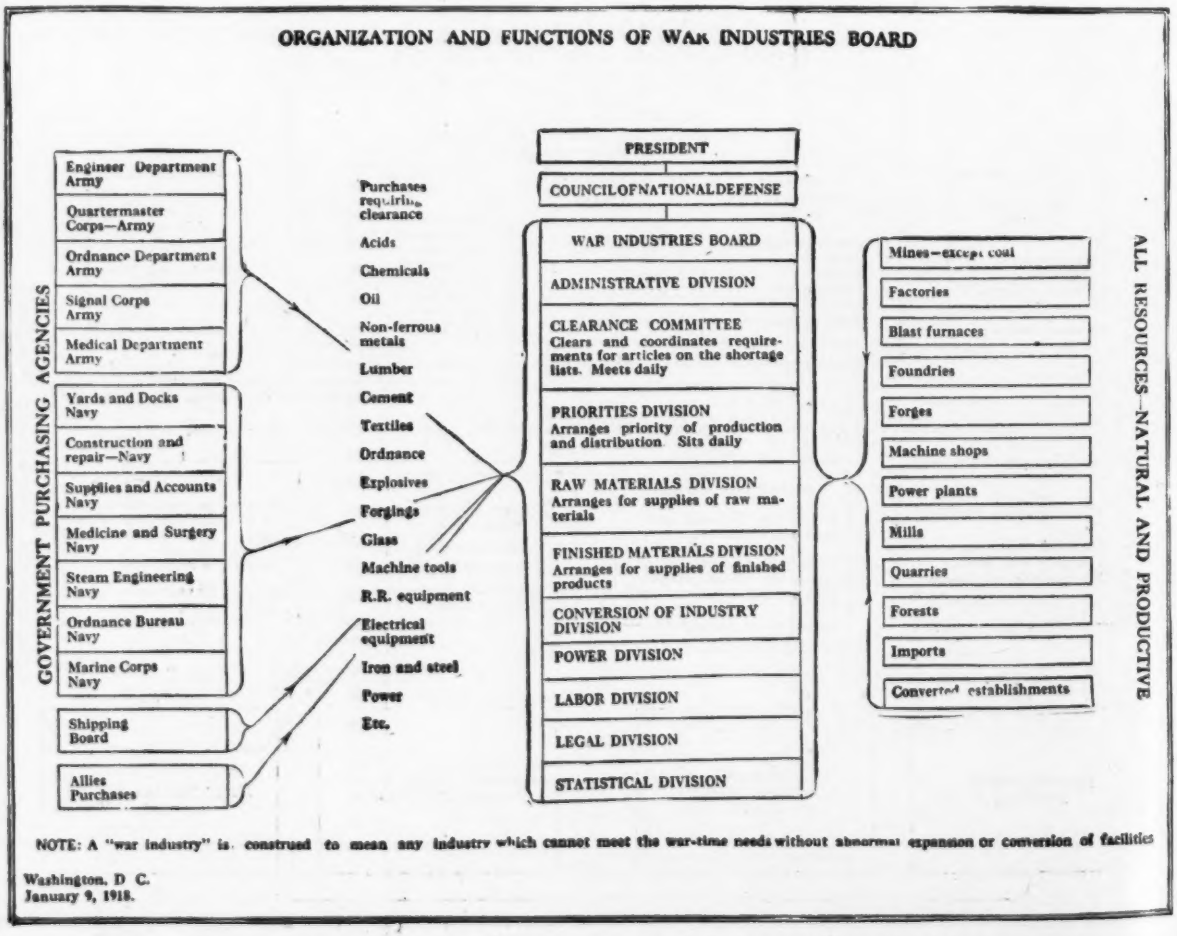
Secretary Baker assured the Senate Committee on Military Affairs that this system of handling the Government war purchases in coöperation with those of the Allies was the best that careful study had been able to suggest, and had met with the approval of the industrial leaders to whom it had been submitted. In his opinion it disorganized none of the existing machinery and interfered as little as possible with meeting civilian demands. It was the equivalent, he believed, of a special director of munitions, for any functions which such a director would have would be possessed by the chairman and executive officer of the War Industries Board. The chairman did not have legal authority to enforce his decisions, but as each of the four great war purchasing agencies had agreed to recognize his decisions as binding, it had not seemed necessary to ask congressional action to confer legal powers upon him.

The essence of the organization, according to Secretary Baker, is that each of the four great purchasers, the Allies' committee, the War and Navy Departments and the Shipping Board, has its own organization for acquiring its supplies in the decided order, while the War Industries Board has these orders filled in such a sequence that war needs, manufacturing and civilian requirements are served in the best possible manner.

This is apparently the administration's answer to the criticism that Washington had no logical plan for mobilizing the nation's resources. According to Secretary Baker, it is the best plan for the purpose that has been advanced in this country or Great Britain.

To Simplify Road Widening

Quite a mileage of 9-ft. brick roads is being built in Florida at present. It is the expectation to widen them when the traffic justifies. Therefore, the concrete curb on the side that will later be in the middle of the road is being poured in 6-ft. lengths, so as to be readily movable. The curb on the permanent edge is placed in 20-ft. lengths.



WAR INDUSTRIES BOARD NOW THE CENTRAL AGENCY FOR ARMY, NAVY, SHIPPING BOARD AND ALLIES' PURCHASES

Market and Warehouses Form Large Building Group

Produce Terminal for Los Angeles Comprises Seven Concrete Buildings Arranged Around Central Court

By L. A. Waterbury
Professor of Civil and Architectural Engineering, University of Arizona, Tucson

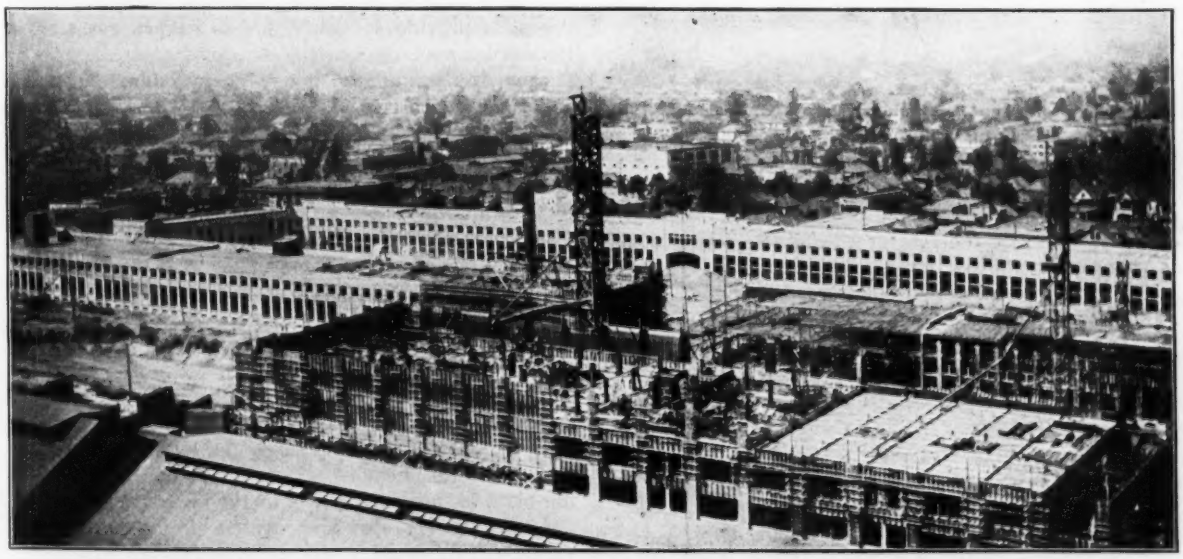
WHOLESALE produce warehouses, a market and offices are combined in a $3,000,000 group of seven reinforced-concrete buildings which the Los Angeles Union Terminal Co. has under construction. The structures will cover an area of 10 acres and have a combined floor space of 50 acres. The general arrangement is shown by the accompanying plan and perspective and the view indicates the construction as it appeared Oct. 11.

Building A will have its first floor used for retail markets and shops, with a branch bank at the corner of Seventh St. and Central Ave. The second floor is designed to include a produce exchange, offices, restaurants and a Japanese rooming house. Two portals through the first story of building A give direct access from Central Ave. to the market yard. For use as a market this area will be subdivided into a number of small areas, to be leased to produce dealers and others. Buildings B1 and B2, both of which are two-story structures, will be used principally as wholesale markets and warehouse, although some of the space in one building will be leased for a box factory.

Beyond these buildings are to be two six-story buildings, C1 and C2, but the construction of the latter may be deferred. Beyond the C-buildings are to be two more six-story buildings, designated as D1 and D2. The construction of the former is well under way, but work on D2 may be postponed for the present. Both the C-buildings and D-buildings will be utilized as wholesale produce warehouses and for light manufacturing, including such industries as a bakery, candy manufacturing, and a refrigerating and cold-storage plant.

The space separating the B-buildings from the C-buildings will accommodate railway tracks serving both sets of buildings, and it will also be used as a service street. The space between the C-buildings and the D-buildings will be used exclusively as a street, the latter buildings being served by tracks on the opposite side, which is adjacent to the Pacific Electric Railway.

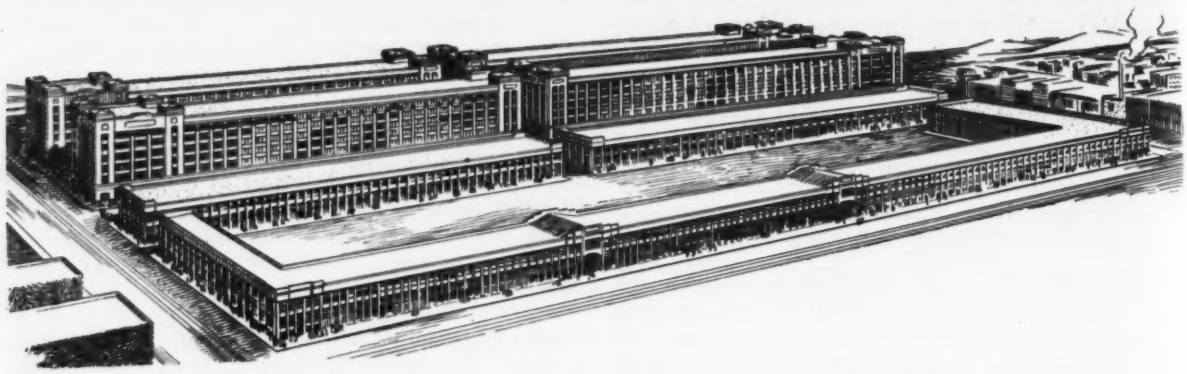
Building A is 40 ft. wide, two stories in height, with no basement. The exterior walls are of reinforced concrete, without other finish. The interior framing is of wood. The typical panel length for the exterior walls is 20 ft. Transverse fire walls of brick subdivide the building into floor areas not exceeding 7500 sq.ft. The first-story floor is formed of 3½ in. of concrete and 1½ in. of an asphaltic mixture. The second floor is finished in part with maple and in part with Oregon pine. The length of the building, including wings, is over 1500 ft. The ground area covered is 61,600 sq.ft., and the floor area is twice that amount. The live load used for the design of restaurants and produce exchange was 125 lb. per sq.ft. of floor, while for offices and rooming house a 75-lb. load was employed.



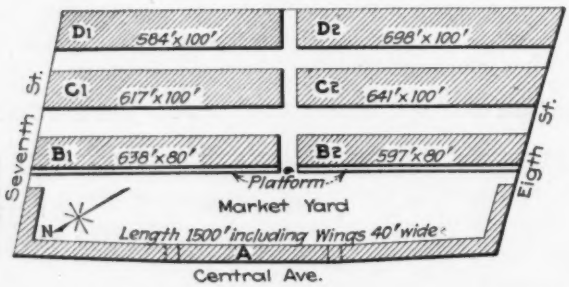
PRODUCE MARKET AND WAREHOUSE PLANT UNDER CONSTRUCTION IN LOS ANGELES. MARKET BUILDING IN THE REAR OF TWO-STORY WAREHOUSES. SIX-STORY WAREHOUSE IN FOREGROUND

Buildings B1 and B2 are similar in construction to building A, but each has a basement extending not only under the building proper but also under the concrete platform which adjoins the market yard. Each of these buildings is divided by brick fire walls into floor areas not exceeding 17,500 sq.ft. Each of these buildings was designed for a live load of 150 lb. per sq.ft. of floor. The floor finish is cement for the basement, maple for the first story, and Oregon pine for the second story.

Buildings C1 and D1 are of reinforced concrete throughout and the plans call for similar construction for the future buildings C2 and D2. Each of these is to be six stories in height, with a basement. The construction is of the beam-and-girder type, with the exception of that portion of D1 which is devoted to



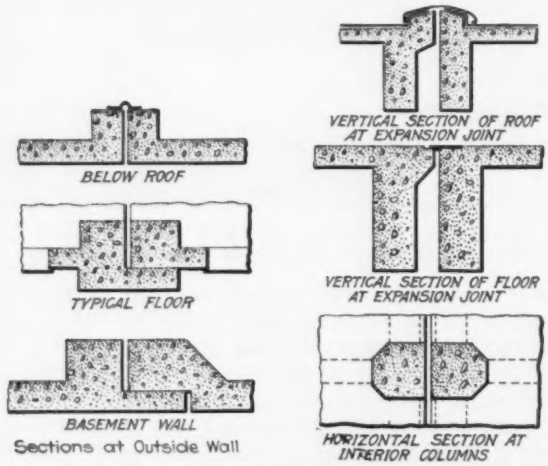
HOW MARKET AND WAREHOUSES WILL LOOK WHEN COMPLETED



PLAN OF BUILDINGS SHOWN IN ABOVE PERSPECTIVE

cold storage space. This section has floor slabs formed of hollow clay tile and reinforced-concrete joists, which in turn are supported by reinforced-concrete girders.

The typical slab for the cold storage floors consists of 14½ in. of tile and concrete, covered with 3 to 5 in. of


BELOW ROOF
TYPICAL FLOOR
BASEMENT WALL
Sections at Outside Wall
VERTICAL SECTION OF ROOF AT EXPANSION JOINT
VERTICAL SECTION OF FLOOR AT EXPANSION JOINT
HORIZONTAL SECTION AT INTERIOR COLUMNS

EXPANSION JOINTS IN REINFORCED-CONCRETE BUILDINGS

cork, which in turn is covered with 4 in. of concrete. The bottom of the slab also has from 3 to 5 in. of cork insulation and ¾ in. of cement plaster. In constructing these floors, the cork for the lower heat insulation was first placed upon the forms, a ½-in. layer of cement grout was placed upon the cork, and the tiles were bedded in this grout. The reinforcement was then placed and the floors were cast to the level of the top of the rough concrete.

The typical size of floor panels, for the reinforced-concrete buildings, is 18 ft. 9 in. by 19 ft. 9 in. between centers of columns. The live load used for the design was 300 lb. per sq.ft. of floor, except that in C1 a load of 400 lb. was used for the first floor, and special loadings were used on the fifth and sixth floors, to provide for loads due to bakery ovens. For typical columns, the bearing area of footings is 14 x 14 ft., and the largest footing of an individual column is 18 ft. square. All of the foundations rest upon sand.

Expansion joints extending through the cross-section of the buildings are provided at intervals of approximately 200 ft. At the outside walls the joint is arranged to be as inconspicuous as possible, the general arrangement being shown by the sections in the detail drawing. The distance allowed for expansion is 2 in. Other sections show expansion joints at the interior columns and in the floor and roof. A steel plate is used to cover the crack in the floor.

Elevators are to be installed in all of the buildings except building A. Electric lighting is provided for all buildings. Heating is included in the contract for building A, but for the other buildings the heating mains only are included. The boiler room for the heating plant is in the south end of the basement of C1.

An automatic sprinkler system is being installed, which will cover all of the buildings except building A. It includes two underground reservoirs with a capacity of 75,000 gal. each, and two elevated steel gravity tanks each having a capacity of 40,000, gal. The bottom of each tank is to be at an elevation of 37 ft. above the roofs of the six-story buildings. The reservoirs are to be constructed under the pavement of the market yard, and between them is to be a pump pit equipped with two automatic fire pumps, each having a capacity of 750 gal. per minute.

The architect for the building in John Parkinson, of Los Angeles, for whom A. L. Bush is chief engineer. The contractor is the Wurster Construction Co., of San Diego and Los Angeles.

Sale of National Forest Timber

More than two billion feet, board measure, of national forest timber was sold in the fiscal year 1917, valued at more than $3,715,000, according to the annual report of the U. S. Forest Service, recently issued. During this period approximately 727,000,000 ft. was cut and removed, for which the purchasers paid $1,507,303.

Turning Back Abutment Wing Walls Saves Material

Revising Layout of Straight Wall Abutments Also Improves Appearance, Particularly in Skew Bridge

By Charles K. Mohler
Consulting Engineer, Los Angeles, Calif.

THE design of short span bridge abutments has not generally received the degree of care and attention that its importance demands. Among the more important features of neglect are those of appearance and cost.

Turning back the wing walls of abutments from the straight line of the abutment face is a common but by no means universal practice. Many abutments of the straight type continue to be built, although in square bridges it results in the use of more material than necessary and in skew bridges it not only wastes material but with improper design leaves an unsightly wall protruding in the obtuse angle of the skew. The saving in material, both masonry and fill, by turning back the walls may be indicated by reference to some typical revisions of straight-wall designs. In these revisions the simple details of the wing-wall layout are given.

In Fig. 1 are shown, on the left, an existing straight wall abutment and, on the right, a suggested improvement in which the obtuse angle of the skew is turned back. The wings of the wall as built were carried out parallel to the face of the abutment to meet the theoretical toe of the slope. On the full (acute-angle) end of the abutment the fill actually tailed out that far. On the slack (obtuse-angle) end, however, the fill, being carried at grade only to the face wall, tailed down the wing far below its top, about as shown in the view of another, but similar, bridge in Fig. 2.

In order to save this excess masonry in the redesign the obtuse wing is turned back as shown, leaving the bridge pedestals in precisely the same location as before, but allowing the fill to tail around the wing, though not to protrude onto the undercrossing.

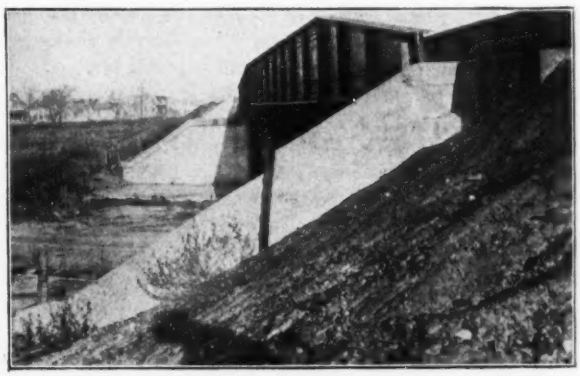


FIG. 2. IN THIS ABUTMENT SLOPE DOES NOT COVER WING WALLS

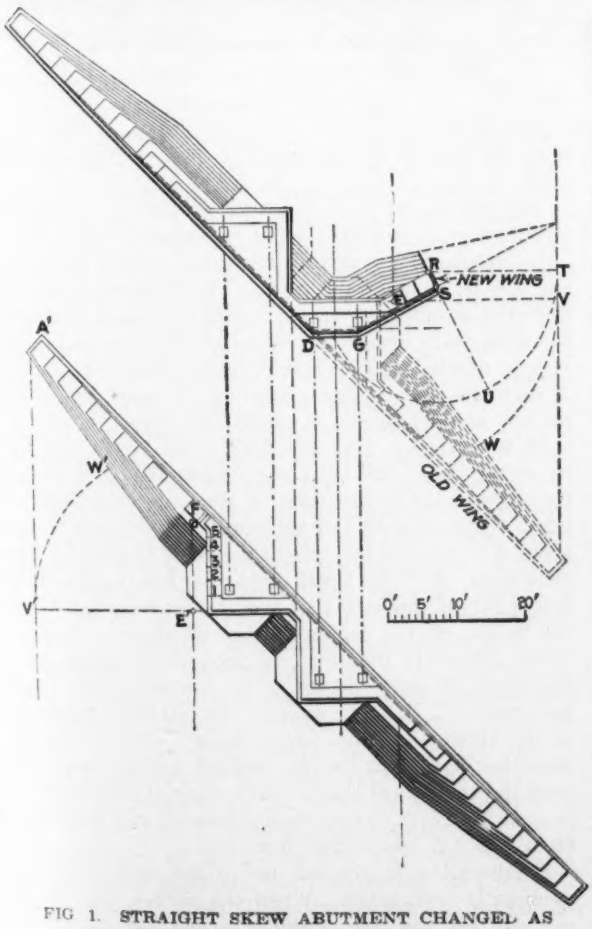


FIG 1. STRAIGHT SKEW ABUTMENT CHANGED AS SHOWN IN UPPER RIGHT WING

The detailed layout is made on the following basis: At D, where the neat line of coping intersects the line of the inside girder, the face of the abutment is turned at right angles to the bridge. At G, the center line of the outside girder, the abutment face is again turned to give the wing angle of 26° 34′. This angle is used so that the tangent comes even inches for even feet. As most bridge abutments are laid out and built by either stone masons or carpenters, who use the carpenter's rule, it is of some importance, or at least convenience, to use angles giving even inches for their tangents, with the foot as the unit of measure.

A wing wall turned back toward the bank not over about 30° is not materially increased in length, even when run out to the bottom of the slope. The main advantage in turning the wing back is to allow room for the embankment to flow around the end and in front of the wall, when the length of the wing is reduced. The revision gives about 35 ft. less length of wing wall than the original plan.

To show that the embankment slope has been properly taken care of in the revision, take R, the intersection of the slope and the back of wall, as a center and with radius RT strike the arc TU. From the point U the radius changes from RU to SU (being reduced by the thickness of the wall), and S becomes the center of the arc or slope flow. Continuing the arc around to the face of the revision wall, it will be seen that the toe of slope, as represented by the arc, falls about a foot short of reaching the face of the original-plan wall.

The advantages of the revised plan are as follows:

1. The saving of about 100 cu.yd. of masonry by re-

ducing the length and in part the thickness of the wing wall.

2. A less amount of fill.

3. Turning the wing back allows the back-wall to be carried straight out to the returned face of the abutment and the reduction of the wall thickness to the theoretical requirements. Where the wing is not turned back the extra bridge-seat thickness has to be carried out to the end of the wing or the backwall turned and brought forward to the face of the abutment.

4. With the wings of both abutments turned back as shown in the revision a much more open and pleasing appearance is given to the roadway from beneath.

F′, a distance of about 13.5 ft., losing about 9 ft. in elevation. The back-wall and wing should accordingly slope down along steps 1, 2, 3, etc., shown in dotted lines. Step 4 corresponds with the top of the coping course. The point F′ is well below the coping elevation. If the coping is carried out full height to the face of the abutment, then steps 4 and 5 would be omitted and their combined height set off at the face angle between 5 and 6. Step 6 would then be the next step actually to intersect the slope at the theoretical point. Beyond 6 the steps should be on a slope of 1½ to 1, rather than the flatter ratio determined by multiplying the regular slope lengths by the cosecant of the angle the bridge makes

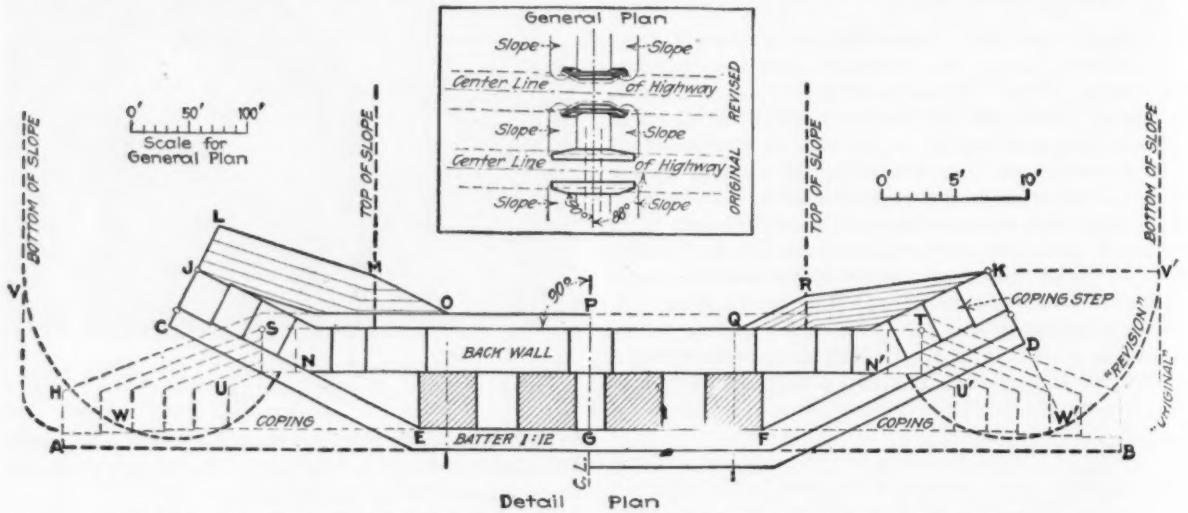


FIG. 3. SQUARE ABUTMENT CAN BE REVISED BY TURNING BACK WING WALLS

5. The displeasing protruding walls are done away with.

The total net saving in cost for the revised plan as against the original would amount roughly to from $1500 to $2000, depending on the character of the masonry. The total cost of both abutments on the original plan would be from $6000 to $8000 and the deck plate girders about $3200. Strictly equalizing the cost of the substructure and superstructure would still further reduce abutment cost from $1000 to $2000. The higher rate of depreciation for steel spans leaves a somewhat greater cost for the substructure generally allowable and advisable.

Another revision possible is to turn the whole wing back at an angle of 90° to the bridge axis. No sketch is given for this, as the wing would be of normal length and slope. The wing may ordinarily be reduced in length to allow the fill to flow around the end in front to meet about the line of the lower roadway.

If it is desirable or necessary to make the wings of a skew abutment straight, the wing projecting away from the embankment should be shortened enough to meet the slope. A full revision sketch to meet this requirement will not be given. Enough can be described from the left abutment in Fig. 1 to illustrate the principles.

There is no requirement to maintain the full width and height of the embankment beyond the point E′. With the original wall designed as shown, having the back-wall and coping parallel to the girder along the line 1, 2, 3, 4, 5, the slope will fall away from E′ toward with the face of the abutment, as used in the original plan.

The end of the wall will be at W′ instead of at A′ and the length of wall saved is represented by W′A′.

In square bridges certain revisions of the wing walls can also be economically made. Fig. 3 shows in dotted lines the layout of a square bridge abutment in which the wing walls are prolongations of the face wall. Revisions of similar type but different detail are shown at each end in solid lines, and in small scale are shown the new and old layouts in comparable form.

In the original plan the wall offsets have left the wings too long. The bank slope meets the outer end of the steps at the bottom, and all steps are on a uniform pitch. The rear of the back-wall steps T and S are about 4 ft. back of the rear of the steps U and U′. The bank slope at 1½ to 1 will drop two feet in the three feet width of the back wall and consequently fall below the bottom of the coping course, which is 1 ft. 4 in. thick. There is therefore no need for a coping step. The drop of slope in the 4 ft. forward offset from back wall is 2 ft. 8 in., equal to the combined thickness of the coping and the course below. It will thus be seen that two steps can be omitted and the wall still meet the theoretical slope. Each wing of the abutment is from 4 to 5 ft. longer than necessary and will stand from 2 to 3 ft. above the bank slope.

Furthermore, in the old design the roadway is unnecessarily obstructed. When the center line of the roadway and the face of the abutment are not exactly

parallel, as in this case, there is much less encroacnment on the roadway with the wings turned back. Compare the "revised" and "original" of the general plan.

The wings can be turned back to reduce length and save masonry and to procure a more open roadway. By turning the wings back they can be shortened and the slope allowed to run around in front of the abutment. This, together with the reduction in length above detailed, gives a total of nearly 7 ft., amounting for each wing to about 14 cu.yd. or 56 in all. The saving in cost is about $450. The "confined" minimum width of roadway between abutments is reduced from a length of about 74 ft. to 26 ft. by turning the wings back. This gives a much more open and inviting appearance.

A particular defect of the original design is that there is no reduction in the thickness of the wall until the end of the back-wall steps at T and S are reached. Thickness reduction should begin at R and M, the edge of top of bank, instead of at the accidental or arbitrary end of back-wall steps T and S. The revision gives a 30 ft. length (MR) of full thickness wall instead of 46 ft. (ST) in the original. In addition the excess thickness of the wall at and below the bridge-seat coping is reduced as soon as the angle is turned at F and E, and has been entirely eliminated before the points T and S of the original design are reached. The length of the excess thickness from R to T and from M to S is about 8 ft. for each. The length of the wedge-shaped excess thickness EN and FN of the revision is also about 8 ft. each, or an equivalent average of 8 ft. for both wings.

The revision shown on the right is more consistent and complete than that on the left. The latter is largely a copy of the original lines of layout.

The total saving by the revisions shown for two abutments would probably amount to $800. The cost of the two deck girder spans would be about $1500 or less than double the amount that could be saved on the abutments by very simple revisions. The revisions shown are by no means all that could reasonably be made.

The approximate amount of masonry in two abutments is 780 cu.yd. The cost for original design at $8 per cu.yd. amounts to $6240. The total for span and abutments is roughly $7740 and the cost of spans is only a little over 19% of the total cost. With the saving on the abutments by the revisions shown, the deck plate girders still represent only a little over 21% of the total cost. This leaves room for still further cutting down the cost by increasing the span and reducing the length of the abutment wings.

Change in Manchester Department of Public Works Advised

City Manager and Research Bureau Engineer Survey Organization and Work of Department of Granite State City

A NUMBER of suggestions of more than local interest were made in what the authors termed a "build-as-you-go survey" of the Department of Public Works of Manchester, N. H., not long ago. The report was addressed to the Manchester Board of Commerce by the Institute for Public Service, New York City, and was made by Gaylord C. Cummin, city manager, Grand Rapids, Mich., and H. S. Morse, engineer, Detroit Bureau of Governmental Research. The portions of the report of most interest to the readers of *Engineering News-Record* deal with proposed changes in the organization of the Department of Public Works.

The department consists of a commission of three members appointed by the mayor. The commission in turn appoints a director of public works, and he appoints heads of six divisions, which, with their duties are: (1) equipment and supplies, having charge of bookkeeping, purchasing, filing, payrolls, etc.; (2) highways, in charge of new construction on streets, sidewalks, bridges and culverts, and maintenance of the same, together with the watering and oiling of streets; (3) sewers, having charge of construction, maintenance and repair of the sewerage system, with the exception of the cleaning of catchbasins; (4) street cleaning, in charge of everything the name implies, including the cleaning of catchbasins, the collection and disposal of ashes and rubbish, and the collection of such garbage as is not collected by private parties; (5) transportation, equipment and supplies; (6) engineering, in charge of all surveys, plans, etc., lines and grades for public improvements, together with the giving of sidewalk grades for private building construction; also in charge of various records and costs, permits for sewer connections, and all engineering work for parks, playgrounds and cemeteries.

Do Away with Commission of Public Works

The authors of the report start in boldly by recommending that the legislature be requested to abolish the Commission of Public Works, which was created by a legislative act early in 1917. The commissioners themselves feel that even under favorable circumstances their value is principally advisory. The report states that such advisory help as the commissioners can give could doubtless be obtained from a non-official body. Since the commission, in less favorable political conditions than now prevail, may in the future give rise to trouble, the report suggests that the commision be abolished and the director of public works be made responsible solely to the mayor.

The report advises that the supervision and operation of the municipal asphalt plant, gravel pit, and concrete mixer (when the latter is in the yard) be transferred from the division of highways to the division of transportation, equipment and supplies. It is thought that this would give rise to better accounting control. Another proposed transfer would place the sprinkling and oiling of streets in the division of street cleaning, instead of in the division of highways. The work might go in either department with equal logic, the report says, but in order to secure a more even distribution of work among divisions, as well as to give greatest stability to divisional organizations, the transfer is advised.

Before the reorganization of the Department of Public Works under the legislation passed early in 1917, the present director of public works served as city engineer. Apparently there has been no city engineer since the

reorganization. The report states that the director cannot properly fulfill the duties of that office and the detailed work of the division of engineering. It is, therefore, recommended that an engineer be placed in charge of the division of engineering under the director of public works. It is stated that "the chief function of the proposed engineer-in charge should be the design of all improvements."

The plan is to have the division of transportation, equipment and supplies "self-supporting by charging for all materials, supplies, equipment, or transportation service rendered to the other divisions." This would simplify cost keeping "and is admirable as a means of control of all materials, supplies, and equipment used by the city."

The report suggests that the same principle might be extended to the divisions of adminstration and of engineering, thus having three self-supporting divisions for which no appropriations should be made in the city budget. At present the division of engineering renders service to the department of parks, commons and playgrounds, and to the trustees of the cemeteries, without charge. Commenting on this, the report says: "While from the taxpayer's viewpoint the ultimate results are the same, for correct accounting a proper charge should be made for such service. Under such a system the division of engineering will be in position to render service on call to these or any other city departments, and will have no reason of self-protection for not doing so, since the cost will be borne by those activities which get the service."

Manchester now has only 13 miles of so-called permanently paved streets. It is estimated in the report that there should be at least 35 miles of such pavements. In support of this, it is stated that in 1916 the cost of street maintenance, not including sprinkling and oiling, was $106,000, while only $90,000 was spent for permanent pavements. The only way to reduce the heavy maintenance cost is to outline and carry out as rapidly as possible a paving program extending over a period of years.

It is recommended that in the next budget provision be made for an additional field party in the division of engineering for the purpose of "revising and extending to the city limits the topographic map of the city and revising and extending the system of bench levels." The present topographic map was made in 1888 and the bench levels were installed in 1901. An up-to-date topographic map "is of the utmost value in planning intelligently for the future development and improvement of the city, and the bench levels are essential to the making of the map and to the accurate construction of the improvements."

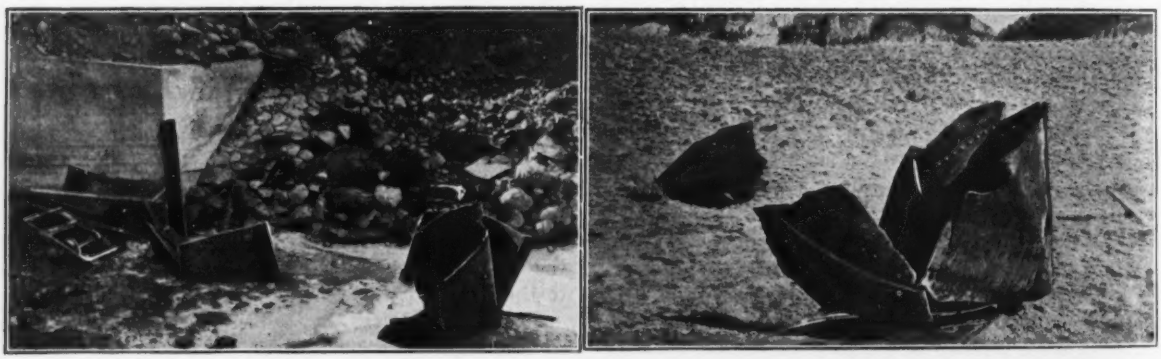
A start toward a centralized purchasing department for the city is advised. At the beginning, at least, it is said that this function might readily be assumed by either the mayor or the office of the Department of Public Works. There is reason for choosing the latter since it "is the largest single purchaser of city supplies and has the organization most readily adapted to purchasing work."

Water Tears Quarter-Inch Tunnel Lining to Pieces

Head of 56 Feet in Santa Maria Lake Dam Rips Steel Without Much Bending or Twisting—Concrete Not Eroded

WATER issuing under a 56-ft. head from two 48-in. pipes into the outlet tunnel of the Santa Maria Lake dam, Colorado, tore a lining of ¼-in. steel into many small pieces as one might tear a sheet of paper. Although this occurred in 1914, the information has only recently been made available through a description given by T. W. Jaycox, consulting engineer, in a discussion before the Colorado Association of Members of the American Society of Civil Engineers.

The outlet control of this hydraulic filled dam, described in *Engineering News* of Oct. 10, 1912, p. 669, and *Engineering Record* of Oct. 12, 1912, p. 396, consists of two 48-in. pipes and one 36-in. pipe with gate valves 5 ft. back from the issuing end. The valves are set in an enlarged portion of the tunnel which has a flat invert, straight sides for 4 to 6 ft. high on the sides, and an arched top. The width tapers from 14 ft. at the end of the pipes to 6 ft. at the regular section of the tunnel, 14 ft. away. The smaller pipe is set in the center and the 48-in. pipe centers are 2 ft. from the side walls.



STEEL OUTLET LINING TORN INTO TWENTY-FIVE PIECES—TEARS DO NOT INDICATE MUCH TWISTING OR BENDING

A pan of ¼-in. steel weighing 4000 lb. was set in this tapered section to line the invert and 4 ft. up the sides. It was bonded to the concrete lining and also anchored by a Z-bar riveted horizontally along the back of the top

edge of each steel plate, which was imbedded in the concrete.

It was thought that the energy of the water would be destroyed by having it swirl in a comparatively small chamber, expending its force against the walls of the chamber and itself, but what the effect would be on the walls was questionable, and to afford greater protection the steel pan, covering the floor and lower part of the side walls, was adopted.

On account of rains in the San Luis Valley there was no demand for storage water in 1914, and the reservoir was at the 56-ft. stage on Sept. 17, when it was ordered to be emptied. The rapidity of the discharge was placed at 450 to 500 cu.ft. per second, to test the outlet works and to observe the conditions when this large quantity of water was running, and also to comply with the request of the state engineer that this run of water be completed before he began seepage measurements on the Rio Grande. Accordingly, 21,000 acre-feet were run out in 30 days and at the rate of 450 sec.ft. for two weeks. Because of the difficulty in turning the stem of the small valve, only the two 48-in. valves were opened. The streams from these valves, having a probable theoretical velocity of 50 to 60 ft. per second and a volume of 200 sec.-ft. or more, discharged directly against the inclined surface of the side plates. In some manner the destruction of the entire steel pan was effected.

An examination disclosed the pan torn away from the concrete and jammed into the small end of the taper. Pieces as small as 16 sq.in. in area, and none exceeding 3 ft. square, were found on the tunnel floor. In all, 25 pieces were recovered. These were assembled and are marked with a cross in the accompanying photograph. Some of the smaller pieces inspected in Mr. Jaycox's office show clean, jagged, torn edges and an excellent grade of steel. The edges showed that they had been pulled asunder, but none was much bent or twisted. These pieces, in Mr. Jaycox's opinion, must have been stripped off while the plates were held firmly in place, as one side would have to be fast in order that the other side might be torn away, or else the whole plate would have moved and no stripping would have occurred. The Z-bar at the left of the picture is the entire length of one inclined side of the chamber, over 10 ft. long. It is not bent, is really as straight as when put in, and was torn from the body of the steel plate and not through the line of rivets joining the plate and the Z-bar.

It would appear probable that one side plate was first destroyed by the water making or finding an opening behind it, and, once having that place, the water soon accomplished the ripping and tearing. This afforded an opening for the water to get under the floor plate, raising and bulging it, so that the edge was pulled from under the discharge pipes. It was then quickly rolled, bent and pushed into the entrance of the tunnel section, where it was found. To remove the pan, it was cut in two pieces by the use of hack saws.

What is considered the remarkable thing about the occurrence was the behavior of the concrete lining under this punishment. Behind the pan, where it was impossible to manipulate a spade, the concrete was quite rough. No apparent damage had been done to it, and no erosion was noticeable. Portions could be broken off, as might be expected from such loosely knit concrete.

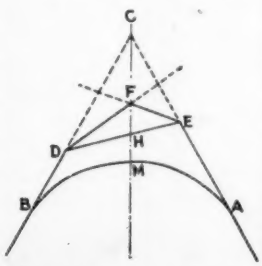
Arthur P. Davis, chief engineer, U. S. Reclamation Service, in *Engineering News* of Jan. 4, 1912, p. 20, gives an account of a similar experience with the lining of outlets of the Pathfinder dam when discharging at 150-ft. head. Nearly all of the steel lining was torn out of the tunnel, all of the concrete thus exposed was carried away and considerable erosive effect upon the granite was noted. He does not tell how the repairs were made. Mr. Jaycox's repairs consisted in the application of a cement mortar coating 1½ in. thick. This has successfully resisted the impact of the water discharged against it for the last three years. This year the head was 70 feet.

Externals Instead of Tangent Distances for Lining Railroad Curves

By C. E. Newell
Corydon, Ind.

ENGINEERS who have occasion to set track centers for railroad curves for which they have no notes may find the following suggestions useful where it is difficult or practically impossible to produce tangents to intersection:

Measure along the center of the existing curve and mark the stationing on the rail. Produce the established tangents to arbitrarily selected points E and D (see the sketch), visible from each other. Bisect the angles CED and CDE and produce the bisecting lines to an intersection at F. Obtain an intersection of the line bisecting the angle DFE with the line DE at H, and the plus to the intersection of the line FH produced with the center line of the existing curve at M. Measure the distances HE or HD and HM.



From these data the external CM of the existing curve can be obtained, as the angle ECH or DCH is one-half the intersection angle, and the angles CED and CDE have been measured. The degree of trial curve having been determined from the intersection angle and the external, the curve can be run in from points one-half the length of the curve either side of the point M. Unless considerable throw is required to bring track to new location it will be unnecessary to remeasure the curve.

In many instances it will prove more accurate and satisfactory to triangulate for the external distances from a right-angle line of a convenient length extending from any suitable point on the external than it will to measure this distance with a tape the distance would have to be measured accurately. In any event the use of externals will prove far superior to the use of tangent distances in doing work of this character.

Almost Completely Sewered

The sanitary sewer system of Palo Alto, Calif., is completed on 97% of the streets, and all houses on those streets are connected with the sewers, according to the annual city report for 1916-17. J. F. Byxbee, Jr., is city engineer.

Standpipe Demolished After Forty Years' Service

Wrought-Iron Structure at Toledo, 224 Feet High, and Inclosed in Brick Tower, Cut Into Sections by Oxyacetylene Torch

BY C. N. SCHOONMAKER
Constructing Engineer, Toledo Water-Works

THE recent tearing down of the 224-ft. standpipe and inclosing tower at Toledo, Ohio, was notable both as a contract job and because the structure was one of the highest standpipes in the country. Moreover, although it had been in use more than forty years it came to its end through obsolescence rather than decay.

The structure was designed by the late J. D. Cook, as a part of the water-works built by Toledo in 1873-4. The standpipe was 5 ft. in diameter, with plates successively ¾, ⅝ and ½ in. thick. It was inclosed by the ornamental brick tower shown by the accompanying view. Space for a stairway on one side and an elevator on the other side was provided between the standpipe and the tower, but the stairway alone was built.

Photographed by I. H. Pariskey
TOLEDO'S INCLOSED WATER-WORKS STANDPIPE SERVED MORE THAN FORTY YEARS

The standpipe and tower were torn down to make room for a new force-main header system, with central valves control—but not until it had been shown by trial that oth the pumps and distributing mains would not be badly affected by direct pumping.

The work of destruction, which extended to the ground line only, was done under a contract let in October, 1916, for $1850 and salvage. The highest of four other bids was $7200 and salvage. Earlier bids were rejected because of lack of competition and high prices. The salvage was reported by the contractor to be 750,000 brick, 37 tons of wrought-iron, and 2600 lb. of lead, the latter from the cornice. The estimated salvage, in advance of the letting, was 1,440,000 brick and 30 tons of wrought iron.

The methods employed by the contractor for the demolition of the standpipe and tower were substantially as follows: The upper half section of the tower was scaffolded. The recesses left in the wall when the stairway was removed were used for beam supports and as these were about 4 ft. apart no additional cutting out was necessary. Construction similar to that used in chimney falsework was carried up from the beam supports, to which a zigzag chute was attached for the removal of all débris, all being taken down as the work progressed toward the ground. A small hoisting engine was used for handling the heavier material.

All metal work was cut in 4-ft. sections and each cylindrical section was then halved so that handling became more easily managed. This work was performed with an oxyacetylene torch.

The work of demolishing the uppermost portion of the tower proceeded rapidly, as the brickwork was set up in lime mortar and was easily removed. The lower half required removal with sledges and picks, as these joints had been made with cement.

The contractors were Doan & Langenderfer, Toledo, who were under the supervision of the Division of Water, of which Thomas R. Cook is commissioner, W. G. Clark, consulting engineer, and the writer, construction engineer. David H. Goodwillis is director of public service.

St. Paul Committee Proposes Minimum Fees for Engineers

Sliding Scale for Definite Services Performed—Additional Charges for Time Beyond Contract Period

MINIMUM charges for professional services are given in a schedule proposed by a committee of the Civil Engineers' Society of St. Paul on engineering compensation. Before adoption discussion is desired as to whether the fees are proper, whether competition is such that it will be impossible to enforce such a schedule, and proper fees for cases not covered.

The engineer's profesional services are defined so as to consist of the necessary conferences, preliminary surveys, preliminary studies and reports, preparation of working drawings, specifications and such detailed drawings as may be necessary for furnishing proper information to the contractors for the preparation of bids for the construction of the work, and the general supervision of the construction work.

For the preparation of a preliminary report with a general plan and an estimate of cost upon any project the fee shall not be less than ¾% of the minimum estimated cost, and no fee for the above work shall be less than $150.

The engineer's charge for complete plans and specifications, including preliminary report and survey, but exclusive of soundings and borings, shall be made according to the following schedule:

For work estimated to cost less than $10,000, 3½% of the total estimated cost of the improvement exclusive of the land; less than $25,000, 3%; more than $50,000, 2½ per cent.

The charge for consulting superintendence shall be 2½% of the cost of the work. This consulting superintendence shall be taken to mean occasional visits to the work and each contract shall state specifically the number of trips which are contemplated. Additional trips shall be charged for at a rate per day with expenses added.

Where work is especially difficult or expensive it shall be proper to charge a fee in excess of the amount specified above in proportion to the increased cost of the work to the engineer.

If the work shall be let to several contractors or under a percentage contract or in any other manner which shall render the superintendence more difficult or expensive to the engineer, a special fee may be charged covering the additional expense to the engineer.

Each engineering proposal shall state specifically the length of time which is considered as proper for the contractor to complete the work. If for any reason the work shall be extended beyond this proper contract period a charge shall be made for such additional expense entailed upon the engineer.

Where the engineer is not otherwise retained, consistent fees for professional advice shall be paid in proportion to the importance of the question involved and the services rendered. The services of the engineer shall not be taken to include the expense of special foundation exploration, tests of concrete, reinforcing steel, or other materials, which service should be done under the general supervision of the engineer by specialists in that particular line of work and should be paid for by the owner directly to the persons making such tests, etc. In case continuous inspection is desired upon any work a resident engineer shall be furnished at a charge per month including his expenses. If, after the preliminary plans have been approved, changes in drawings, specifications or other documents are required by the municipality, or if the engineer shall be put to extra labor and expense by the delinquency or insolvency of the contractor, the engineer shall be paid for such additional services and expense.

The personnel of the committee is as follows: W. E. King, T. F. McMahon, A. F. Meyer and J. F. Druar.

Navy Could Change Site and Annul Contract but Could Not Collect

In a case involving a suit over the construction of a sawmill, boiler house and steel stack at the Mare Island Navy Yard in California, the Supreme Court of the United States recently held that, under the circumstances, the Navy Department had been within its rights in setting aside the first contract and reletting the work, but on the other hand, could not recover damages, since the change in location of the plant involved such extensive changes in the design of the structure that the second contractor, who actually carried out the work, built something different from what the first contractor bid on. Consequently the first contractor was not liable for the difference between the amount of his bid and the final cost of the work. The first contractor also recovered for materials delivered and used by the Government.

The case was a suit by the California Bridge & Construction Co. against the United States, based upon alleged breach of contract, to which the Government set up the defense that the contractor had defaulted in the performance of the contract and that the Government had secured its completion by a new contractor at a greatly increased expense. On this ground the Government set up a counter-claim for the excess in the cost of completion under the second contract above what the Government would have had to pay to secure the structure under the first contract.

The president of the California Bridge & Construction Co. visited the navy yard before bidding and saw the ground staked out for the proposed structure. He was informed, however, by authorized officers of the United States that the location had not been finally determined and was subject to change. After the contract was entered into the location was changed to another, where construction was more difficult and expensive, particularly in requiring longer foundation piles.

The Supreme Court held, in view of the information given to the contractor before bidding, that the site was not finally selected, but was liable to change, and inasmuch as the contract stated that the sawmill was to be erected "at the U. S. Navy Yard, Mare Island, Calif.," the structure might be placed anywhere in the navy yard that the Government might wish, and the contractor was without just cause for complaint if any available site were selected. Since the contract contained a clause providing that upon the report of a board of officers of the Navy, showing that the progress of the work was not such as to indicate that it would be completed within the time specified, the Government would have the power to annul the contract and complete the work at the expense of the contractor and his sureties the Supreme Court held that upon the contractor's refusal to build on the site finally selected it was entirely proper for the Government to exercise the power of annulment and relet the work. It held, on the other hand, that before the Government could recover the excess cost of completion from the first contractor, it was necessary for the work to be completed in substantially the same manner as was contemplated in the first contract. It was held by the Supreme Court in the Axman case, decided in 1914, and reported in 234 U. S. Reports, p. 36, that "Where, after default of the original contractor, the contract is relet, the original contractor is not bound for difference unless the contract as relet is the same as the original contract."

This principle was applied to the case in question, although the new contract was made on substantially the same specifications as the old, because by supplemental agreements the Government made a number of important changes, involving particularly the length and size of the foundation piles used, and making a difference of about 6% in the total contract price.

The court also held that the Government must pay for materials brought upon the ground by the bridge company, which had been seized by the Government after only partial payment had been made.

The case was argued in November last, by George A. King, of King & King, for the contractor, and Assistant Attorney General Houston, for the U. S. Government.

Cement Plant Again Under Municipal Control

The portland cement plant built for the production of cement for the Los Angeles Aqueduct has again returned to the possession of the City of Los Angeles. The Public Service Department of the city on Sept. 27 took possession of this plant, which had been under lease for the Board of Supervisors of Los Angeles County.

Malaria-Control Engineering in Texas Increases Labor Efficiency

Mosquito-Prevention Work Done Along a Large Railroad—Dallas Eradicates Anopheles Mosquito Haunts by Draining, Clearing, Oiling and Stocking Streams with Minnows—Lives and Dollars Saved at Small Expense

By Charles Saville and H. W. Van Hovenberg
Director of Sanitation, City of Dallas
Sanitary Engineer, St. Louis Southwestern Ry.

MALARIA-CONTROL engineering is a relatively new field for engineers engaged in health protective activities. It combines opportunities for original research with a return on the financial investment that is prompt and certain.

Malaria undoubtedly ranks first in practical importance among endemic diseases in the Southern states. The U. S. Public Health Service estimates that 4% of the population of the 13 Southern states suffer annually with the disease. Careful surveys recently made in three east Texas counties showed that in some localities 50 to 70% of the rural population were infected, and that the annual cost of the disease per family, for doctors' fees, medicine and loss of wages, amounted in some cases to from $80 to $100. It is thus clear that the presence of malaria in a community may often become a decided drawback to commercial and agricultural development as well as to military preparedness.

Dallas Cut Malaria Two-Thirds

It is now known that malaria is spread from an infected person to a person in good health by the bite of the female of a particular variety of mosquito, the anopheles, who lays her eggs on clean, quiet water surfaces, preferably in protected spots along grass-covered edges of streams or pools. The practical solution of the malaria problem is found in ridding the infected area of the breeding places of the mosquito. The City of Dallas, Tex., undertook this method of malaria control in the summer of 1916. After a year of intensive work, costing 3c. per capita, the death rate from malaria decreased 66.7% and the number of cases of the disease reported to the health department fell to an average of only two or three per month. Any community may obtain like results.

During the year that ended Aug. 1, 1916, a total of 27 persons died in Dallas of malaria, or more than died of scarlet fever, diphtheria, measles, smallpox, spinal meningitis and infantile paralysis combined. It is estimated that possibly six of these 27 victims were non-residents. As the accepted ratio of deaths to cases of sickness is approximately 1 to 400 for this disease in the United States, these 21 city deaths indicate that approximately 8400 persons in Dallas suffered from malaria during the year. From May to December, 1916, 163 patients were treated for malaria at the city charity hospital, at a cost of about $2000, which was a tax half as great as the cost of successful malaria-prevention work for a year.

What Gould Did on the Southwestern

The St. Louis Southwestern Railway Co. may be taken as an example of a large and progressive business corporation that has recognized the value of malaria eradication. A recent study of health conditions on the railroad, and in the large employees' hospital, convinced Edwin Gould, chairman of the board of directors, that the malaria situation was acute. As a result he provided from his own purse a trust fund amounting to many thousands of dollars for fighting the malaria mosquito and for improving health conditions among the fifteen thousand employees of the road living in the states of Missouri, Arkansas, Illinois, Louisiana and Texas.

Malaria Reduction a Military Problem

The location of army cantonments and aviation schools in the South and the concentrating of enlisted men in many towns has called for prompt action to protect our soldiers from malaria. At all encampments this malaria problem is receiving attention from the regular Army authorities, while some of the communities adjoining the encampment sites are getting rid of malaria through the coöperation of the U. S. Public Health Service, the American Red Cross, and the state, county, and municipal authorities.

Even in those communities which have no malaria problem of consequence the mosquito pest is being given consideration, for it is obviously impossible to put troops through grilling hours of training unless they have proper sleep. Press dispatches indicate that the work on the cantonment site at Yaphank, N. Y., was delayed seriously because laborers refused to work in opposition to the swarms of mosquitoes. One of the writers recently discovered ordinary house mosquitoes (not the malaria-bearing variety) breeding in enormous quantities in the basement of a large armory in which several hundred soldiers were quartered. These men had just been vaccinated for smallpox and immunized against typhoid, and many were in wretched physical condition, because the mosquito pest made rest imposible.

Forty Miles of Malaria-Breeding Streams Cleaned Up

The malaria situation in the City of Dallas was acute at the time the malaria control work was begun. In an area of about 17 square miles there were some 40 miles of water courses favorable to the development of mosquitoes, with the possibility of spreading malarial infection among the 140,000 residents of the city from the beginning of the mosquito season in May to the cold weather of November. The natural topography of Dallas facilitates the draining of standing water and the training of streams to give them sufficient fall. There were many large resident districts of the poorer class that were sorely beset by mosquitoes because they bordered creeks that had never been properly cared for. Several of the largest parks were also located along streams where thousands of people seek recreation after

nightfall, only to fall prey to the disease-carrying mosquito that ordinarily is "on the wing" at dark, but gives no warning of her presence, because she does not make the same loud humming noise that is characteristic of the more common rain-barrel mosquito.

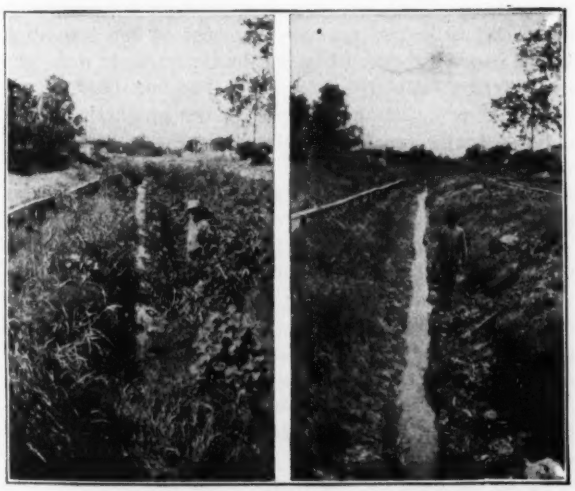
The writers believe they are conservative in their opinion that before the inauguration of the malaria-control work Dallas was well within the average of 4% infection annually for inhabitants in the 13 Southern states, estimated by the U. S. Public Health Service.

How Dallas Did It

With this situation, then, malaria-control work was started in May, 1916, the work being carried on by the division of sanitary engineering of the department of public health under the supervision of the writers. The field equipment included short and long handled shovels, hoes, trench spades, picks, rakes, grass-cutting tools, axes, storage oil barrels, 5-gal. oil cans, two Meyers Bros. No. 330 G. I. knapsack sprayers, and a Ford runabout equipped with a delivery wagon body.

In order that Dallas might benefit fully from the experience of other places in this particular line of work, the active coöperation was secured of the Malaria Field Investigation Branch of the U. S. Public Health Service, whose trained physicians and sanitary engineers have fathered the Dallas work through regular visits to the city, and through aid given in every possible way to the local public health officials in their conduct of the work.

Attention was first given to those portions of the creeks and ponds that were active anopheles breeding places, and then extended to include all important mos-



CLEANING THE SIDES AND BOTTOM OF THE STREAM DESTROYS MOSQUITO-BREEDING PLACES.

quito breeding spots. The work consisted in both cases in:

(a) Clearing of banks of grass, weeds and débris, to destroy shelters and facilitate ditching and oiling.

(b) Ditching of streams to get channels of minimum cross-section, with sufficient stream flow to keep the channel scoured.

(c) Filling large holes situated under bridges and at ends of culverts, pot holes in creeks, over-flow pools, etc.

This work was followed by oiling water surfaces at regular intervals or, where feasible, by stocking with, or cultivating the growth of, top feeding minnows in streams and ponds.

The field work embraced six main streams having a total length of 30 miles and an average high water channel width, before the work started, of approximately 30 ft. Extensive marshy areas were also drained by ditches, several thousand feet in length, reclaiming many acres of valuable land for agricultural and business purposes. The field force comprised five to ten men during the summer months. They were paid 25c. an hour in 1916, and 30c. in 1917.

Creek Bottoms Swept with Brooms

Algae growth and moss were removed from the creeks by sweeping with a stable broom. Attractive sign posts giving police warning were erected to discourage throwing of trash in streams and to prevent mischievous boys from building dams. A municipal ordinance was adopted to compel the removal of mosquito-breeding areas on private property. Along with actual field work, an educational campaign was carried on through public lectures, health department publications and exhibits. Some little work was also done on a malaria index with microscopical examination of specimens of blood taken in various parts of the city. Thirty per cent. of the inhabitants of the Mexican quarter that were examined were found infected with malaria parasites of the tertian type.

Approximately 30 of the 40 miles of creeks under control proved to be regular anopheles breeding areas, which had to be continually recleaned and retrained. About 300 gal. of a compounded oil were used monthly. The oilers waded down the creeks with knapsack sprayers on their backs, replenishing their supply of oil at regular filling stations. The cost of field work on the six principal streams, including all supplies, wages, automobile expense, and supervision, during the active mosquito season, averaged about $16 per month per mile.

Lives and Dollars Saved

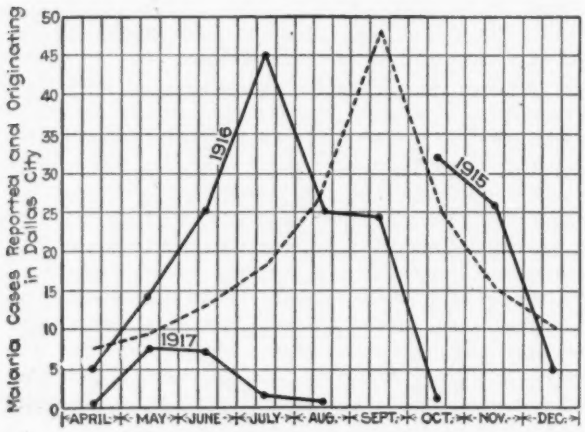
The value of any health activity is judged by the decrease in the number of cases of sickness and in the reduced death rate. The records of the Dallas city registrar show that there were 27 deaths in Dallas during the year ending Aug. 1, 1916, which was before anti-malaria work was well started. During the following 12 months there were only nine deaths from malaria, a reduction in mortality of 66⅔%, despite a material increase in population. Assuming the value of a life to be $3000 and the cost of an average case of malaria, for medicine, attendants, and wages lost, to be $25, and using the ratio of one death to every 400 cases, we find a probable economic saving to Dallas inhabitants through reduction in the disease to have been nearly $200,000, or about $1.25 per capita. Compare this saving with the 3c. found to be the actual cost per inhabitant of effectively controlling malaria. What other investment yields so great a return?

An indication of the reduced prevalence of malaria in Dallas is shown by the records of the City Charity

Hospital. Only four patients were treated for this disease in July and August, 1917, as compared with 85 such patients in the same months in 1916.

The increased tendency of Dallas people to spend their holidays at public and private recreation centers about Dallas led to the control of anopheles breeding at a municipal fishing and picnic grounds situated some six miles from the city, which had always been known as a place where many of the Dallas malaria fever cases originated. This area is now under control, is becoming more popular every day and has ceased to be a source of infection of Dallas people. At the present time the prevention work is being extended to afford protection to the aviation camp which is located close by.

It is not claimed, of course, that all of the greatly reduced malaria prevalence observed in Dallas during



MOSQUITO-CONTROL ACTIVITIES MATERIALLY REDUCED MALARIA IN DALLAS, TEXAS

Dotted line shows normal seasonal distribution of malaria in north and east Texas as determined by the U. S. Public Health Service in communities where control measures are not in force. Full lines show seasonal distribution in Dallas before and after introduction of control measures. The breeding places of the malaria-bearing mosquito were first brought under control about July 15, 1916. Observe that apex of curve for 1916 was reached in July instead of September, showing how rapidly reduction in prevalence of the disease follows malaria-control activites.

the past year is directly the result of the health department's activities, because in problems of this sort there are usually special factors involved; but it must be evident to anyone who has carefully considered the greatly improved conditions found throughout the city, and their practical value to the taxpayer, that the recent expenditures for anti-malaria work have already been repaid many times. A low death rate is a far better investment than a low tax rate. Systematic malaria-control measures in any community should in fact be looked upon as a paying business investment, and, what is still more important at this time, as a definitely patriotic duty.

Chicago's Building Industry and the War

What are Chicago's reasonable requirements as a war-material center for internal growth? This is the intent of the industrial survey which a committee of the Chicago Association of Commerce has under consideration. This investigation, which is the result of a meeting attended by engineers, bankers, architects, material dealers and others, will take up the following points: Demand for buildings, financial aspect, cost and supply of material, legislation and labor.

Irrigation Project Is Based on Economic Use of Water

Limited Supply Necessitates High Duty—Standard Dam Section Employed in Comparing Reservoir Sites

ORGANIZATION of an irrigation district in the Victor valley, California, "along such lines as shall best make for economic use of the water available," is the subject of a report to the Board of Supervisors of San Bernardino County. This report was submitted in August by the Mojave River Commission composed of W. F. McClure, J. A. Sourwine and C. E. Tait. Mr. Sourwine is county engineer.

The Mojave River constitutes the chief drainage system on the north slope of the San Bernardino mountains. Its flow is periodic, and the lower levels of the stream go entirely dry in the summer. The governing condition is a limited quantity of water and plenty of land. Therefore, the problem for the district was not, how to deliver water upon any particular land, but rather the development of a project giving actual and reasonably immediate use of water on some land within the valley. The commission had to consider the agricultural and land development aspects of the situation as well as the more strictly engineering subjects. Small units of development are considered necessary for a successful initial project in the Victor valley.

Duty of Water for Irrigation

The crops on the greater part of the land must be such as to permit a high duty of water, in order that the water available may be made to serve the maximum area, and in order that the acre-cost of the irrigation works may be reduced to a minimum, so as to make the project financially feasible. It is recommended, therefore, that the valley be utilized for the production of deciduous fruits (such as apples and pears), so that any irrigation system need provide only the less amount of water required for such fruits instead of the greater amount that would be required for alfalfa.

Investigations of 49 orchards in nine districts, with a total area of 1330 acres, show an average of 0.82 acre-feet of water per area. The maximum was 1.79 and the minimum 0.33. Classifying the orchards with regard to ages of trees, the amount averaged 0.62 acre-foot per acre where the trees are less than five years of age, and 1.11 acre-feet where they are over five years. Only two to four irrigations per year are required for such orchards.

As to the duty of water, it is recommended that this should be estimated at 1.25 acre-feet per acre for the west mesa and 1.50 for the east mesa, the latter having a slightly lower rainfall. No allowance is made for loss in distribution. On the other hand, no account is taken of the land that would be devoted to buildings and therefore would not require irrigation. This item is taken as 15% in the estimate of cost. It is considered that these two items would balance approximately, so that the duty recommended above would determine the gross area that may be included in a project.

The average annual run-off of the Mojave River, where it enters the Victor valley basin, is approximately 90,000 acre-feet. About 33% of this is avail-

able for storage by the West Fork reservoir project. The above average is deduced from a study of rainfall records for a period of 18 years, which includes one year of low flow. The range of the annual records during this period is from 13,378 to 169,935 acre-feet.

Underground water may be pumped to serve certain portions of the district, but a gravity supply of water is necessary for the irrigation and reclamation of the greater portion.

Study of Soil Moisture

Investigation of the amount of moisture that should be maintained in the soil has been made in order to determine the "wilting coefficient" of the soil—that is, the minimum percentage of moisture which will keep plants from wilting. This coefficient multiplied by 1.84 gives approximately the percentage of moisture supplied by an irrigation. The report states that the moisture should not be allowed to fall below this coefficient during the growing season, and the closer it is maintained to the coefficient multiplied by 1.84 the better the results should be.

To determine the "wilting coefficient," borings were made to depths of 6 ft. or more, soil samples being taken at 1 ft. intervals. This depth is considered sufficient for the roots of deciduous fruit trees. For the east mesa the average was 6% (3 to 9.6%), while for the west mesa it was 5.3% (3 to 8.1%). The water required to produce a moisture content above the wilting point is 0.52 acre-feet and 0.45 acre-feet, respectively.

Standard Cross-Section for Dams

Dams are required for the two reservoir sites selected on the West Fork. To obtain some standard for comparison an "excessively safe" section of gravity dam was assumed, all dimensions of which were expressed in terms of the height (H). The width for 0.20 H from the top is 0.15 H. The section then widens in the form of a trapezoid to 0.65 H at the base. The area of cross-section is 0.33 H^2.

Putting this area in terms of only one variable, the height, does not offer the most effective or economic section, but it does offer for purposes of preliminary study a section of sufficient strength and one allowing of comparison with other dams. From cross-sections of the dam sites and by assumption of the above arbitrary cross-section of dam, an estimate was made of the yardage for the respective dams, for varying depths and varying capacities.

In order to present the results in the forms of a cost curve, rather than a curve of concrete yardage, a unit cost of $6 per yd. was assumed for all concrete to be used in dams. The cost of the respective dams was then computed for varying heights from 10 ft. to 150 ft. and the capacity for the same height was determined. The total cost of each height was then divided by the capacity for that height, and the unit cost for the given capacity was obtained. These various unit costs for different capacities were plotted on cross-section paper, and were found to lie on a fairly uniform curve. A smooth even curve line was drawn through the points then determined, and a unit-cost curve was thus obtained for varying capacities of each reservoir.

The economic upper limit of storage for one reservoir was found to be 35,000 acre-feet, and the cost for this would be $34.50 per acre-feet. At the same cost the upper limit for the other reservoir was 34,000 acre-feet. Taking this price as the limiting economic value for unit cost, the lower limit of economic storage was found to be 28,000 and 9400 acre-feet respectively.

Either of these reservoirs is suitable for the first initial project which may be developed. The report states that it is gratifying to find such possibilities for economic storage based on such small project units. It is on these small project units that hope is based for a successful initial project in the Victor valley.

For the ultimate development of the West Fork run-off a much larger storage is desirable, and for this the commission considered a possible combination of the two reservoirs. An economic cost-curve was prepared, and this indicated several interesting features.

As an instance, it showed a remarkably wide range of storage possible through economic combinations of the two reservoirs, without any wide variation in unit cost. By proper economic combination of the two reservoirs, a combined storage of 60,000 acre-feet can be obtained at a unit cost of approximately $33.25 per acre-foot, while a combined storage of only 66⅔% of this amount, or 40,000 acre-feet, can be had for $33.50 per acre-foot or approximately the same cost. There is an intermediate between the two values, of 52,000 acre-feet storage, at a unit cost of $32.85 per acre-foot, while a decrease of the total combined storage to 31,000 acre-feet serves to increase the unit cost only to $34 per acre-foot or less than 4% above the intermediate condition. The report points out that this indicates a possible flexibility of design which is very desirable and which is seldom obtained.

Economic Area for Development

In the development of a practical initial project, the area to be first put under cultivation is an important item. The report points out that if the project is too large it becomes unwieldy. It is then difficult to carry and develop it within the period during which development must take place if the project is to become self-supporting before it collapses from carrying too much dead weight in the way of non-productive and non-remunerative acreage. On the other hand, if the project is too small it will generally reach a limit where the first cost is too high and the overhead proportionately large, and the resultant unit cost will be prohibitive to success. Where a project can be found which offers nearly equal unit cost for varying degrees of magnitude and growth, the conditions are unusually favorable to successful development.

This appears to be the case with these upper West Fork reservoirs. Still, there is a practical limit to the small initial unit of construction, to go below which would necessitate unnecessarily heavy costs for additions to the project, as it became desirable to increase development. The commission is of opinion that the approximately effective size of such an initial project should be from 15,000 to 18,000 acres.

Recommendation and Cost

The commission recommends for the first unit the completion of the larger reservoir to a capacity of 33,000 acre-feet, which will allow a safe annual draft of about 20,000 acre-feet. With a duty of 1.25 acre-feet

this will supply an irrigated area of 16,000 acres, or an irrigation district of 18,400 acres (allowing 15% for lands not cultivated).

The estimated cost is $1,705,300, divided as follows: Dam, $1,125,300; spillway, $20,000; land, $40,000; feeder system, $198,000; distributing system, $322,000. Interest charges during a two-year period of construction would bring the total cost to $1,797,800, or $97.70 per acre. As this estimate is based on the arbitrary section of dam noted above, it is expected that a final estimate would be 10 to 15% lower, giving a unit price of approximately $90 per acre, including interest charges.

Pressure on Inclined Cuts of Timber by Simple Diagram

By C. A. Melick

Associate Professor of Civil Engineering, Michigan Agricultural College, East Lansing, Mich.

THE subjoined diagram for Jacoby's formula, which I find to be quite a timesaver in the design of timber details, is constructed as follows:

Lay off AC equal to the unit-stress permitted for bearing on the ends of the fibers, and CB equal to the corresponding unit-stress across the fibers. On AB as a diameter erect a semicircle. Through C and A draw a series of parallel lines such as CF and AD. Project D, the point where AD cuts the semicircle, on the diameter AB, giving point E. With C as a center and CE as a radius, swing arc EF, cutting line CF at F. Then CF equals the allowable unit-stress on a surface AD inclined to the fibers AB of the timber at an angle $\theta = DAB$.

As will be noted from the diagram, $CF = CE = CA - AE = CA - AD\cos\theta = CA - AB\cos^2\theta$. Using the notation given in Jacoby's "Structural Details," page 254, $CA = S'$ and $AB = S' - S''$, then $CF = S' - (S' - S'')\cos^2\theta = S'\sin^2\theta - S''\cos^2\theta$, which is Jacoby's equation for the permissible unit-stress on a surface inclined at an angle θ to the fibers. By constructing a curve through a well-selected set of points F and drawing concentric circular arcs with centers at C for rapid interpolation of allowed units, the diagram is complete.

To use the diagram, let it be required to find the allowed unit on the truss-joint surface CG in the small sketch. Place the base AC of the diagram (which should be constructed on transparent material) to cover the fiber AC of the stick with whose fibers the cut BC makes the smallest angle, in this case the horizontal stick. Then read, at the point where CG (or CG produced) cuts the curve, the allowable unit-pressure in pounds per square inch.

The ease with which such a diagram can be constructed and the fact that two curves, one for a common soft or cheap hardwood and another for oak blocks, may be readily constructed on the same diagram makes the device especially convenient. I prefer a diagram drawn to a scale of 1 in. = 400 lb. per square inch.

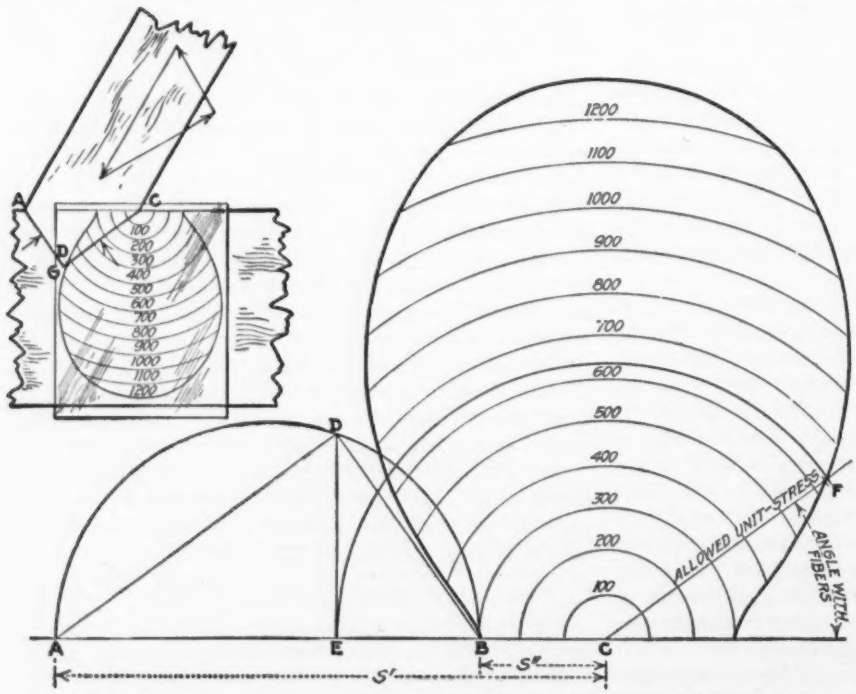


DIAGRAM FOR ALLOWABLE LOAD ON INCLINED CUTS IN YELLOW PINE
For Jacoby's Formula, $S' - (S' - S'')\cos^2\theta$, with $S' = 1300$ and $S'' = 300$ lb. per sq.in.

Motor Trucks To Be Used for Parcel-Post on Star-Routes

Within perhaps the next three months motor truck parcel-post routes, aggregating between 3000 and 4000 miles, will be in operation in various parts of the country.

One chain of motor routes will extend from Portland, Maine, to New Orleans. Another will cover much of a large stretch of territory in Ohio, Indiana, Illinois and West Virginia.

On the Pacific Coast routes will be established between San Francisco and Sacramento, and between Redlands and Los Angeles, California.

The existing law does not provide for the employment of Government-owned motor trucks on rural-delivery routes, nor does it require the rural carriers to use motor vehicles in the service of such routes.

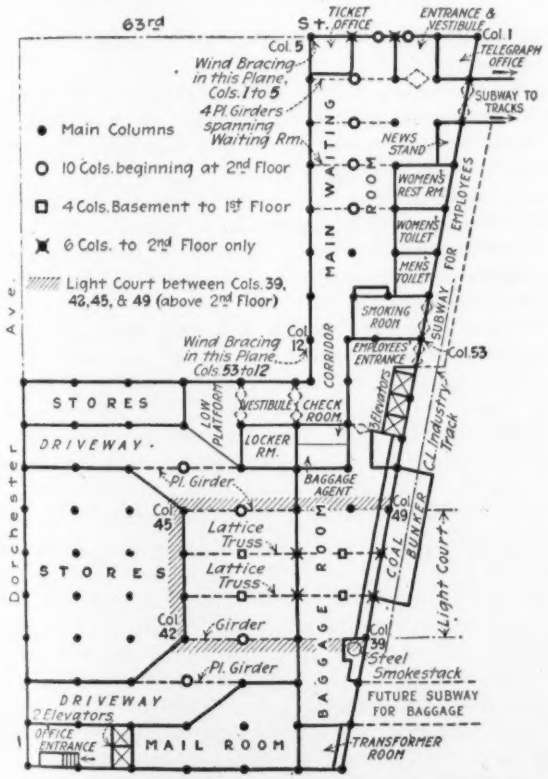
In the star-route service, however, where the mail is carried under contract, a recent law permits the Post Office Department to designate the sort of vehicles to be employed, and in awarding new contracts the department will specify that motor trucks shall be employed on all routes where the roads are such as to admit of their use. These contracts are advertised for bidders, and where payment asked for the service is deemed to be excessive the department is authorized to provide Government-owned motor trucks and to employ drivers for the operation of these routes.

Railway Station Is Combined with Tall Office Building

Illinois Central Moves Some of Chicago Offices to Suburban District—Building Has Steel Frame and Ribbed-Slab Concrete Floors

TAKING advantage of the lower land values, the Illinois Central R.R. has recently erected a large office building in a suburban district, utilizing the main floor as a passenger station. The building is adjacent to the right-of-way at 63rd St., a stopping point for both through and suburban trains. The company's present down-town office accommodation is overcrowded. As the work of the accounting department does not need to be in close touch with the city offices, it was decided to erect a special building at 63rd St. for this department and to utilize this also as the new station.

The building is nine stories high, but designed for an ultimate height of 13 stories. It is of irregular shape



PLAN OF COLUMN LAYOUT AND STATION FLOOR OF OFFICE BUILDING OF ILLINOIS CENTRAL R.R.

(see plan), with a frontage of about 300 ft. on the railway, and is set back far enough from the elevated main tracks to permit of laying an industry track between them and the structure. This track will serve also for the handling of coal, ashes and supplies at the building, as indicated on the plan.

The building was erected during 1916-17. It was designed by D. F. McLaughlin, architect for the railway, and the construction was in charge of Frank R. Judd, engineer of buildings. The design and construction were under the direction of A. S. Baldwin, chief engineer of the Illinois Central R.R. The contractors were the Henry Ericsson Co., for the foundations, and James Stewart & Co., for the superstructure.

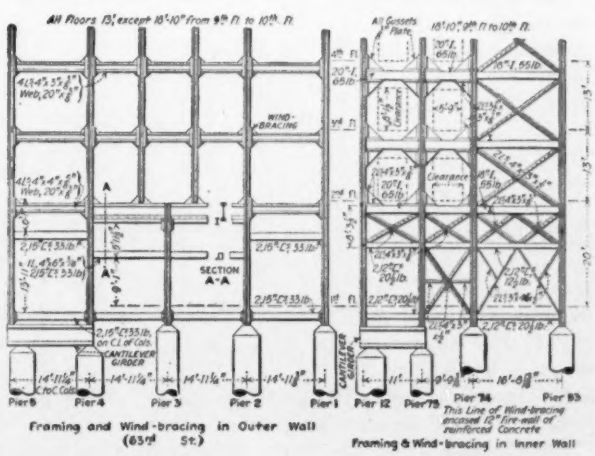
Nearly the whole of the first floor is given up to station facilities and stores. On the second floor is a lunch room and cafeteria for the use of the public and the employees. This is equipped for serving lunch promptly to a thousand persons. The upper floors are devoted entirely to the various branches of the accounting department.

An entrance for employees is provided on the track side of the building, a subway connecting this with the transverse subway which gives access to the platforms. On the Dorchester Ave. side is a carriage entrance leading to a driveway loop, which is paved with creosoted wood blocks. An entrance for pedestrians, at the narrow end on 63rd St., leads directly into the waiting room, close to the subway extending under the tracks. This entrance being most convenient for suburban passengers, the principal station facilities are left free for main-line passengers.

The upper floors are of the loft type, with no interior walls except for a few special departments. The wing is utilized as filing space for records, and is separated from the main portion by a 12-in. wall with firedoors. There are five hydraulic elevators. One set, at the railway side, has one for freight and two for the employees. The others are near the street entrance to the offices. Stairways are inclosed by firewalls to permit reducing the number of fire escapes. The latter are iron stairways with full treads.

The heating and ventilating plant will provide for delivering washed and tempered fresh air. A circulating system will provide cooled drinking water. The boiler and engine room are in the basement, under the baggage room, and a 6-ft. steel smokestack extends up through the building.

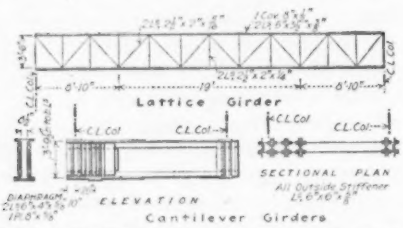
The building is of steel-frame construction. It is founded on concrete piers, some sunk to rock at 60 ft.



STEEL FRAME AND TWO SYSTEMS OF WIND BRACING

below street level and others sunk only to hardpan at 25 to 30 ft. At the property lines the centers of the piers are set back 3 ft. 3 in. from the property line, and the exterior columns are carried on cantilevers, as shown in one of the drawings. These consist of heavy box girders incased in concrete. Their cantilever arms are 25 in. long, and are seated on fulcrum castings similar to the column base castings. All piers carrying these cantilevers are founded on rock.

The basement is 7 ft. below city datum (water level), and special care was made to have it dry and watertight. Its floor is made of two separate 6-in. layers of concrete. No waterproofing medium is used, and the concrete is the 1:2:4 mix employed throughout the building. In this floor, however, a specially dense mix was obtained by using reground cement. This was of



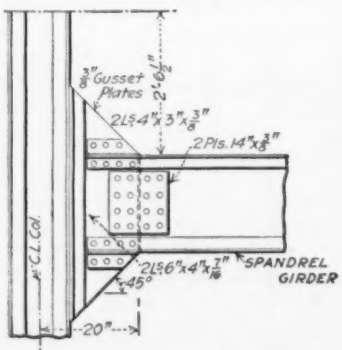
CANTILEVER FOUNDATION GIRDERS FOR LIGHT COURT

such fineness that 98% was passed by a 200-mesh sieve.

The windows are of the Wilson "Reverso" type, in which each sash is reversible, so that both sides can be cleaned from the inside. These are made by the McFarland Hyde Co., of Chicago. Galvanized-iron frames and sash are used, with wire-glass panes where required by ordinance.

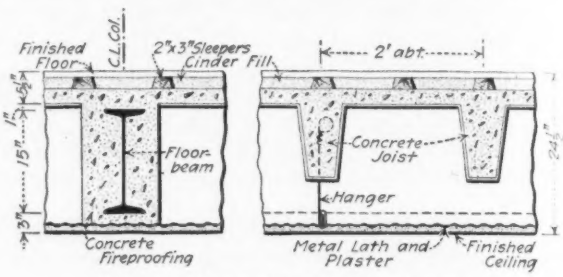
The steel columns are of H-section. The waiting room and the driveway are spanned by heavy plate-girders to carry the intermediate columns of the upper floors. Above the second floor is a large light court. A skylight at the bottom covers part of the driveway and the baggage room. This is carried by lattice girders on columns which extend only to the second-floor level.

The wind-bracing arrangement is shown in one of the drawings. The narrow tapering wing has wind-bracing in both ends. At its 63rd St. front (64 ft. wide) this consists of gusset plates between the spandrel girders and the columns. At the 34-ft. end, joining the main building, diagonal bracing of pairs of angles is used. These are embedded in the firewall, and provide a clearance of 5 ft. 9 in. x 8 ft. 1½ in. for openings. In the main building, certain floors have horizontal wind-bracing consisting of struts composed of pairs of channels, and diagonals composed of pairs of angles. These are embedded in the concrete slab.



WIND-BRACING CONNECTIONS

The concrete floors are of the ribbed-slab type built with Berger trough forms, as shown in the detail. The panels average 16 x 18 ft., and the ribs or joists are spaced 24 in. c. to c. They are designed for a floor load of 75 lb. per sq.ft. in the office space and 150 lb. in the filing space. The roof is of similar construction, as it will form the future tenth floor. It is covered temporarily with a cinder fill having a cement finish, on which an asphalt built-up roofing is applied. The solid parts of the roofs of the light courts have a finished surface of concrete on the cinder fill. The floor concrete is covered with a 3-in. cinder fill in which are embedded wood



RIBBED-SLAB CONCRETE FLOORS

sleepers or nailing strips for ¾-in. edge-grain yellow-pine flooring.

The concreting of the floors was carried on during the winter. The concrete materials were heated, as is usual in such cases. To prevent freezing of the concrete in place, the sides of the building in the story above and below the new floor slab were inclosed with heavy canvas. Salamanders were placed inside, and the completed floors were covered with straw. The falsework and forms for floors were left in place for about three weeks.

Virtually all the concrete was proportioned 1:2:4. The concrete mixing plant was placed between the railway and the building. The concrete was dumped from the mixer into wheeled carts which were hoisted in an elevator tower and run into the building. This tower was at one of the outer corners of the light shaft.

Missouri Puts Convicts on Roads

The use of convict labor for road work was begun recently in Missouri by the State Highway Department, and the first camp has been established at Mineola. The Mineola special road district had voted bonds to pay half the cost of constructing the eight-mile link of the National Old Trails road within the district. Finding it impossible to secure local labor, the district induced the county court to make application for 30 men from the state prison. Of these, 25 are employed on the road and five for cooking, laundry and camp work. The road district pays the State Prison Board $1.25 per day for each man actually engaged in road work, and the State Highway Department will reimburse the district for half this expense as the work progresses. The $1.25 covers the cost of housing, boarding and transporting the entire camp, and also includes the salary of a foreman supplied by the prison board, and the services of the cooks and other men required to maintain the camp. Only "honor men" are employed. They work without guards and do not wear prison uniform. To obtain this labor, application must be made through the county court to the State Highway Department and the State Prison Board.

SOCIETY SERVICE

A Section Dealing with the Results of Teamwork by Technical Men

Exhibits Speed Up Conversation

Seeking to make easier the conversation between its members and guests, the Western Society of Engineers has been using exhibit boards with the idea that engineers are naturally not good mixers and need some ready-made topic with which to begin an acquaintance. It is held that the young man especially will find it much easier to get acquainted when a concrete subject of interest to both parties to a conversation is at hand.

Four sheets of 4 x 8-ft. wall board into which thumb tacks press easily are covered with photographs or drawings showing something of news interest. About 100 pictures, including a number of panoramas, of the army cantonments were used as a start. War maps are posted. Views of army transport service, both here and in France, utilizing trucks and trailers made up another board. Drawings issued by the U. S. Departments of Commerce and Labor and used in teaching shipbuilding to carpenters and other artisans were sent by K. G. Smith, director of engineering extension, Iowa State College, who had the matter in charge. The British recruiting station in Chicago has promised to furnish for an evening an exhibit of war relics and of photographs taken in action. Once it became known that the committee having the matter in charge desired such material, plenty of it was made available.

Employment Activities of Two Societies

Since 1910 the Boston Society of Civil Engineers has had a bureau of employment for its members. Two lists are maintained, one of men desiring work and the other of available positions. Each man is given a number, and his record is published in the society's monthly journal. Positions open are also published, if requested, but usually the length of time which elapses between the filing of requests and the publication of the journal is too long for employers to wait. It is reported that this system has been successful, and that a considerable number of men each month obtain positions in this way. However, owing to the tremendous demand for engineers on war work, the bureau now has little to do.

The Western Society of Engineers, Chicago, maintains a similar service, except that its lists are published in a monthly news bulletin issued separately from the journal. This service is handled in a systematic way, but some changes are to be made in the routine. Cards indicating positions wanted and vacant are posted on the bulletin board in the rooms and a start has been made by the secretary toward getting in touch with the employment departments of various companies in Chicago.

Applicants for positions are requested to fill out record sheets which are filed subject to inspection on application to the secretary. Specification sheets of positions open are required of employers.

The applications of fifty men and as many positions open are on file at present. A special service recently rendered to the U. S. Quartermasters' Corps consisted of obtaining 25 engineering applicants for civilian duties.

The question of bringing down to date the service records of all members of the society, by means of a suitable questionnaire, is under consideration.

With a few other notable exceptions, this feature of practical society service is handled in a spasmodic and rather unsystematic way. *Engineering News-Record* is of the opinion that more can be done without placing undue burdens on the secretaries, and invites discussion of ways and means of furthering the service.

LETTERS TO THE EDITOR

Comment on Matters of Interest to Engineers and Contractors Will Be Welcome

Should Engineering Students Be Drafted?

Sir—The new rulings promulgated by General Black relating to engineering students will, if I understand them, make every student of military age and physically fit subject to draft, but those who come up to the required standard will be given special training to fit them for special military engineering.

This seems to be a very sensible way of making those of special ability into military engineers. It gives those who have real red blood a chance to show it, and at the same time allows them to finish their education. If this awful war continues we will need them all, for our sons must bear the burden which we old fellows can no longer carry.

There are many students, I am sure, who would gladly enlist but for the fear, not of the Boche, but of going through life with no chance for an education. This new ruling gives them the chance of an education and also allows them to prove their willingness to "do their bit."

F. J. MACISAAC.

New York City.

What Is the Matter with a College Education?

Sir—"There is nothing the matter with a college education," is the only answer of every graduate and college student to the query of M. J. Henoch, which appeared on page 48 of your issue of Jan. 3.

A college graduate is just as human and as near mortal as a pile-driver or dock-builder foreman in that he too must start at the bottom of the ladder. The graduate, however, has the advantage in that his climb up the ladder will be made easier, more certain—and the ladder will be higher than that of the pile driver. The two ads quoted by Mr. Henoch will prove in themselves that the college graduate has the better position, when all things are considered. After two years out of school the graduate is offered $10 per week in a permanent

position and, the chances are, with a company stronger financially than the contractor. In addition he is given every opportunity to advance.

True it is that the pile driver now earns $60 per week; but how many years of experience are necessary to qualify him for that salary? The average pile driver who earns $60 per week is 35 or 40 years old, and 22 or 23 is the age of the college graduate. This same pile driver, probably starting in as an apprentice machinist or general roustabout, was glad after his first two years of work to be earning $12 or $15 per week. These figures, at least, held true before the conditions of war raised common day wages to their present level. Furthermore, the pile driver has a job only good until the completion of that one contract, when he must hunt another job. When hard times come the pile driver is in a line of business among the first to be affected.

Does Mr. Henoch believe that the college graduate after the same number of years experience will be limited to $60 a week?

PAUL J. KEELER.

Akron, Ohio.

Flange Bracing of Through Girders Needs More Discussion

Sir—The bracing of the top chords of plate girders and trusses has three important duties: 1. To carry the wind pressure; 2. To resist centrifugal forces; 3. To stiffen the chords. Provision necessary for (1) and (2) is well standardized. On the other hand very little is known in regard to (3), which is involved in the discussions p. 470, Sept. 6, and p. 1074, Dec. 6, 1917, of *Enginering News-Record*.

The writer while still at college constructed several model pasteboard bridges. During his teaching this work was continued in the stronger materials, wood and steel. One model, now in the author's drawing room, is 21 ft. long and 3 ft. wide, representing to one-sixth scale a steel highway truss of 125-ft. span. It has $\frac{1}{2}$-in. rivets and $\frac{11}{16}$-in. pins, the latter being employed at the shoe, which at one end of the bridge are fixed and at the other have roller nests. In fact the steel and timber models were made with scrupulous care to keep the details like those in practice except as to size. The importance of bracing for stiffness has been well demonstrated by these models. All of them, even those of pasteboard, showed marked instability under their own dead weight until the proper lateral bracing was inserted.

It would be safer to assume the responsibility for a thoroughly braced steel highway truss bridge with the stresses ranging around 20,000 lb. per sq.in. than for one with deficient lateral stiffening where the more normal unit-stress of 15,000 prevails.

In many structures, bracing for wind will provide sufficient stiffness. For one thing, it is seldom that (1) and (3) will approach their maximum at the same time, and the two loadings, speaking very roughly, cause about the same stresses. In very large structures, however, this question becomes very important, and similarly in those where the combined forces are likely to act simultaneously, for those where stiffness is very important (as in railroad bridges with their large impact factor), or in those where there are no wind stresses (as in some building work). With these exceptions in mind, the writer has ventured in the "Design of Simple Structures" to offer the following rules:

"Where the ends of the chords are held firmly in position, as in the usual elevated railroad construction with the longitudinal girders framing into the cross-beams, provide for a transverse load equal to one-thirtieth of the safe compressive strength of the chords considered as short struts. Use the average section if the composition varies from point to point.

"Where the ends would be free to turn except for the bracing provided, as in through plate-girder bridges, design for a transverse load equal to one-tenth of the safe compressive strength of all compression chords considered as short struts."

Most questions of design in structural work are pretty well standardized. Various methods have been employed, considered theoretically, and discussed among engineers until loads, analysis, allowable stresses and so forth are fixed to a certain extent. But, as indicated by Mr. Conklin's excellent article, current literature contains but one reference to this subject. It seems therefore that an extensive discussion of the subject might throw added light on the subject. Examples of bridges which have failed through lack of lateral stability should prove very instructive. It is especially desirable that such structures be compared with the requirements of the above rules or of any others which might be suggested.

It is particularly felt that young engineers cannot hear too much about stiffness and rigidity in structural design, for they are prerequisites for durability and safety.

HORACE R. THAYER,

Pittsburgh. Carnegie Institute of Technology.

Success of Treeplanting Device

Sir—In *Engineering News* of Mar. 15, 1917, p. 432, there is an article by Hugh Smith, Minneapolis, which describes a tree planter developed by me, and used by the Minneapolis, St. Paul & Sault Ste. Marie Ry. in planting trees along its tracks.

When this article was printed the machine was still in the experimental stage, and only one had been used. We were not ready then to say just what the results would be.

It can be said now that the trees planted in 1916 grew splendidly in 1917, in spite of the dry weather, and two more machines were built last spring. This year more than 5,000,000 trees were planted. The last machine was built as an attachment to a tractor.

T. A. HOVERSTAD,

Agricultural Commisioner, Minneapolis, St. Paul and Sault Ste. Marie Ry.

Minneapolis.

Building Hydroelectric Plants as Easy as Planting Potatoes

Sir—To prevent any of your readers who are engaged in hydraulic or electrical engineering from getting exaggerated ideas of the difficulties of their work, an extract from an editorial in the Worcester *Telegram* of Dec. 19, 1917, is inclosed. In it the writer takes the popular way of "doing his bit" by giving advice to

the farmers of Maine, who apparently control the water-power of that state. The writer says:

"The mathematical problem is simple. Locating the sites on streams and lakes and building the dams are as simple matters as planting potatoes, and all this country is waiting for the electric power to use in place of millions of tons of coal for which we are paying individual miners $5000 a year for the digging. We are paying more for the imperfect power of coal than we should pay for the perfect power of the streams and lakes reduced to electric currents. And we fuss and worry about the coal. With the work well done in Maine we should have only to press the button and enjoy life without a worry."

While I realize that you have no space for a "joke column," I regret that the abundant supply of humorous matter furnished by the daily press when discussing technical matters cannot be utilized for its real value.

Worcester, Mass. A. L. HEYWOOD.

The Man with Something To Sell

Sir—In the article by Charles J. Bennett, "Hard-Surface Pavements for State Highways," *Engineering News-Record* of Nov. 22, p. 954, the author makes a statement which, from our point of view, deserves commendation and emphasis. It appears under the subheading of "The Man With Something to Sell," in which Mr. Bennett says that one of the requisites to be demanded in connection with pavement sales is "a broader-minded attitude on the part of the pavement salesman, coupled with the same honesty that is demanded of the highway engineer."

We recall an editorial in *Engineering Record* of Nov. 11, 1916, which was very much along this line. It was stated that some promoters of roads were proceeding on the theory, profitable temporarily perhaps, of "going while the going was good," but that their policy was shortsighted. Incidentally, the same thought was contained in a letter from this company sent out in May last, and addressed to engineers and the press, in which it was urged that both portland cement and asphalt be used in highway construction as Mr. Bennett has used them. The reason was set forth in the concluding paragraph of the letter, which was as follows:

"The element of self-interest in these suggestions is this: That we believe the highest success of any product is dependent upon its wisest—not necessarily its largest—use."

Without question, sincere coöperation on the part of engineers and manufacturers of road materials would be attended with better results than are now obtained.

D. T. PIERCE,
Executive Assistant, Barber Asphalt Paving Company.
Philadelphia, Penn.

Variations in Transit Needles

Sir—In a letter in your issue of Dec. 13, p. 1119, W. Newbrough asks for the experience of others in regard to the variation in transit needles. In the official survey of mining claims and other public lands it is now required that the true bearings of all lines be given, usually determined by solar observations, but the old rule that the variation of the needle at all corners be noted is still kept in force. In noting the variation for this purpose the writer has found that there is sometimes a difference in the results using different instruments. As a rule this difference is slight, but occasionally a needle is found which differs from the general run quite decidedly. One instrument used by the writer always shows a variation about 1° greater than that found by other instruments on the same work.

It is also found that in certain places the same needle will give differing results at different times. The best illustration of this coming under the writer's notice was as follows: The instrument was set up on a high rocky point and a true north line laid off, the needle being set at zero and left free. In a short time it was noticed that the needle was pointing about 30′ off, but there had been no change in the line of sight. The instrument was in this position for several hours, during which the needle varied several times. The day was partly cloudy, and it was found that the pointing of the needle varied with sunshine or shadow on the rocks, undoubtedly due to static electrical conditions.

There should always be a constant slight increase in variation as one goes north, but the writer found one district where there was a distinct jump of half a degree in crossing a strip a few hundred yards wide, while the variation remained the same for miles on each side of this point. These conditions are not caused by any constant local attraction. In work with modern methods they are only matters of academic interest. Occasionally in retracing old property lines originally laid out by compass surveys a study of such matters will be of practical assistance. A. M. STRONG,

Of Veuve & Strong, Consulting Engineers.
Los Angeles.

Easy Method of Computing Area of a Circle

Sir—The following method of computing the area of a circle may be generally known, but I have never seen it in print, and give it for what it may be worth:

Area of circle = $D^2 \times 0.7854$

	If D = 4	D^2 = 16
		0.7
Multiplied by 0.7		11.2
Multiplied by 0.07		1.12
Multiplied by 0.014 = (0.007 × 2)		0.224
Multiplied by 0.0014		0.0224
	0.7854	12.5664

The method is simple and easy and explains itself.

Greenville, Mass. B. B. GORDON.

Federal Aid Road Act in Full Force

According to a recent report from the U. S. Department of Agriculture, all the states of the Union have availed themselves of the opportunity of participating in the benefit of the Federal Aid Road Act. When it is realized that in 1916 only $41,000,000 of state funds were expended for highway purposes, and that in 1917 this figure had risen to at least $60,000,000, it can be readily seen that the passage of the act has done much to stimulate road construction. A number of the states have made specific appropriations to meet federal aid dollar for dollar, among these being New York, Illinois, Michigan, Rhode Island, Nevada, Iowa, Florida and Vermont.

HINTS FOR THE CONTRACTOR

DETAILS WHICH SAVE TIME AND LABOR ON CONSTRUCTION WORK

Use Steel Pipe as Cement Shed on Dam Construction Job

STEEL pipe, 84 in. in diameter, is used to store cement at the dam being constructed on the Dead River, in Michigan, for the Cleveland-Cliffs Iron Co. The pipes for the flumes are 35 ft. long, and as each is unloaded it is blocked up, so that water cannot enter at

SEVEN-FOOT PIPE HOLDS 1000 SACKS OF CEMENT

the ends. The cement is unloaded directly from cars to pipes, and the ends of the latter are closed with boards or evergreen boughs. Each length will accommodate 1000 sacks. As the cement is continually being withdrawn for use, and as there are 10 to 15 lengths of pipe available, the contractor, The Foundation Co., is spared the expense of building storage sheds. L. C. Jacobs is superintendent on the work.

Find Cushion of Two-Inch Rope Best for Driving Concrete Piles

IN DRIVING a number of precast concrete piles at one of the yards of the Navy Department last fall a great deal of trouble was saved and faster driving secured by using a cushion of 2-in. manila rope. The piles, which were 30 ft. long and 12 x 12 in. in section, reinforced with a ¾-in. rod at each corner, were driven with a No. 1 Union hammer. The inelastic piles and the quick-striking, double-action hammer did not make a good combination, damage being done to the piles and the hammer, and delays resulted from both causes.

A large quantity of worn 2-in. manila hawser was available at the yard, and it was easy therefore to employ this material for cushions. These were made by simply coiling old pieces of rope until a circle large enough to cover the pile head had been made. Although each cushion has to be thrown away after its first use, one man was able to make sixty of them in a few hours. As, under the conditions, the driver had a capacity of about twenty piles a day, this was sufficient for three days' work.

The method was resorted to after it had been found impracticable to use a follower and wood-cushion blocks. It is stated that with the use of the rope cushions the penetration of the piles was increased and damage to the piles and hammer eliminated.

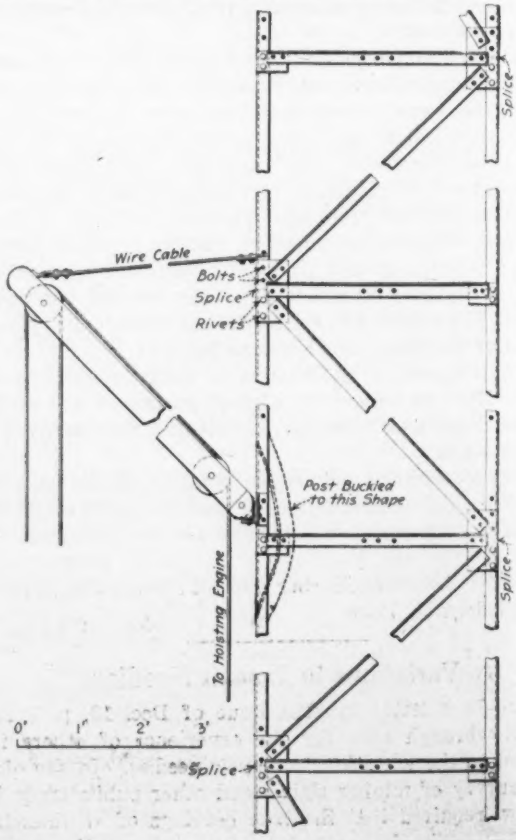
Replace Buckled Post Near Middle Without Taking Down Steel Tower

By John T. Sullivan

Civil Engineer, Roos Bros., Contractors, Cincinnati

WHILE lumber was being hoisted to one of the upper floors of the Industrial Arts Building of the new East Side High School in Cincinnati, the load began to spin, and the hoisting lines became crossed. A heavy strain was put on the boom, which buckled the corner post at which the boom was seated, as shown in the accompanying sketch. Although there was 132 ft. of steel tower above the buckled section, it was taken out and replaced without taking down the tower.

The bearing timbers were inserted underneath the second horizontal member above the boom seat and on top of the first horizontal member below it. A timber and a shoring jack were inserted to restore the tower to plumb and take the weight off the damaged section. The second panel part above the boom seat had to be



BUCKLED SECTION WAS REPLACED IN NINETY MINUTES

used as the upper support, since the gusset at the first panel point was riveted to the damaged section of the angle post and had to be removed with it.

After slight strain had been taken on the jack the bolts in the damaged section were easily loosened and the section was removed. The jack was then tightened and the corner raised to its original level, after which the new section was inserted and bolted.

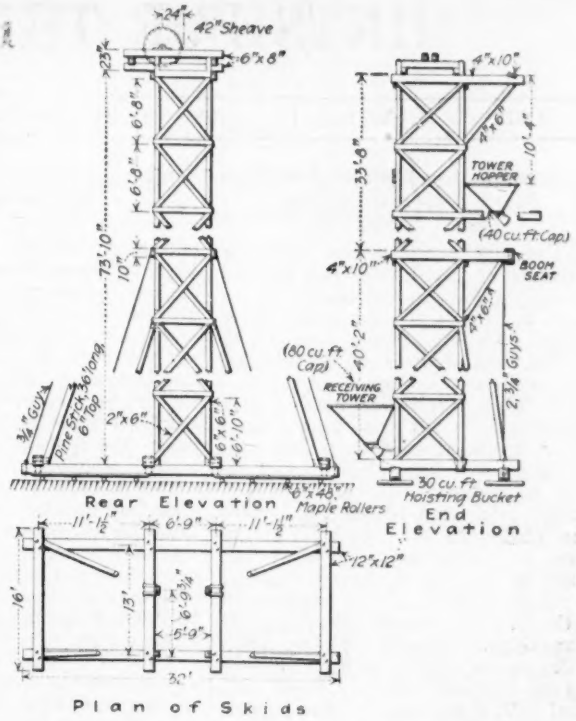
The entire repair had been completed within 1½ hours after the accident. In the opinion of the writer the small amount of trouble and delay occasioned was due to the fact that the accident occurred with a steel tower. Had it happened with a wood tower the corner post might have snapped off and caused the collapse of the entire upper part of the structure.

Traveling Concrete Tower Flanked by Two Derricks Builds Spillway

BY L. G. ARNOLD
Formerly Assistant Superintendent, Wissota Dam

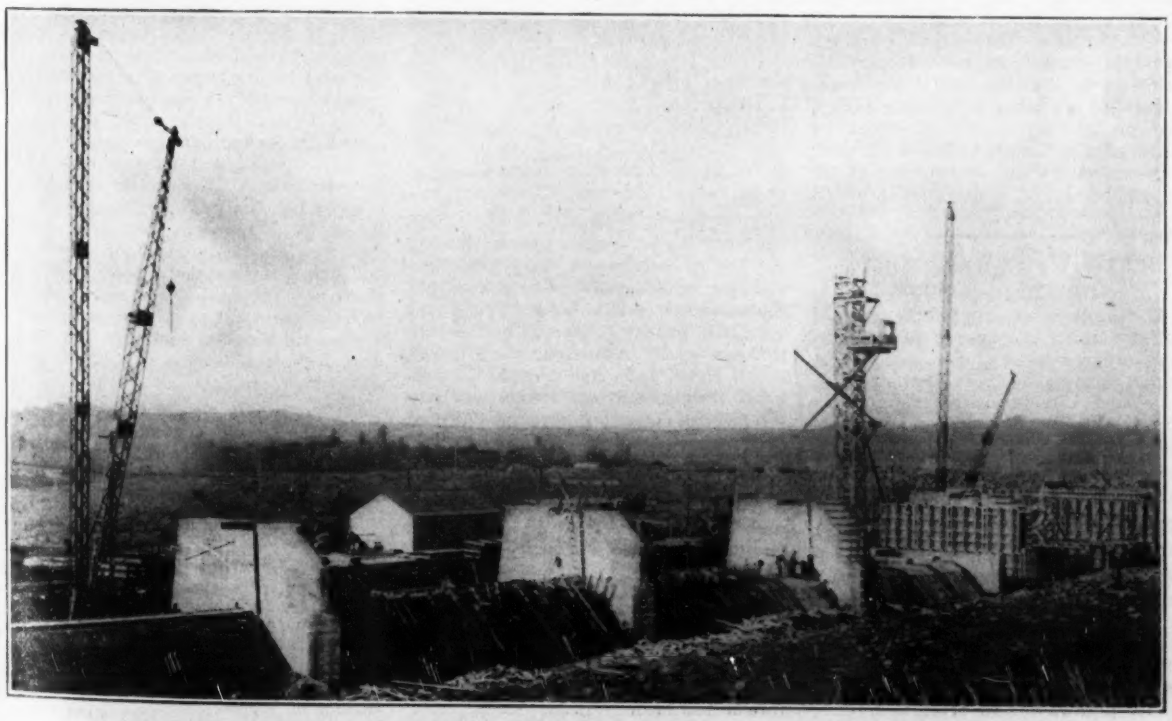
IN CONCRETING the spillway of the Wissota Dam the movable tower shown in the drawing and photograph worked between two large guy derricks which set up and stripped forms for the various buttresses and decks, shifted the chutes for the concrete plant and pulled it forward or backward as required. The concrete tower and the derricks themselves were moved on a track on short trestle bents of standard construction.

Concrete was carried to the plant in two 5-yd. electric concrete cars from the central concrete plant. These cars operated on a standard-gage third-rail electric railway which crossed both channels of the river. Concrete was dumped from them into the receiving hopper and hoisted in a 30-cu.ft. bucket. The tower had a radius of operation of 150 feet.



TOWER WAS PULLED ALONG BY DERRICKS

It was quite common with this method to average 300 yd. of concrete a day. Approximately 12,000 yd. was handled with this plant between Oct. 10 and Nov. 17, at a remarkably low unit cost. The Wissota Dam, located near Chippewa Falls, Wis., was built by the Wisconsin-Minnesota Light & Power Company.



PAIR OF DERRICKS, ONE ON EACH SIDE, HANDLED FORMS FOR MOVABLE SPOUTING PLANT

NEWS OF THE WEEK

CURRENT EVENTS IN THE CIVIL ENGINEERING AND CONTRACTING FIELDS

Estimating the Cost of the Proposed Imperial-Laguna Dam Connection

After the announcement that the Secretary of the Interior had granted permission for the construction of a canal to supply the Imperial Valley system from the Laguna Dam. C. K. Clarke, chief engineer of the district, was authorized to prepare an estimate of the work involved in making such connection. In the brief time allotted for the preparation of these first estimates, it was impossible to compile final or detailed figures. However, certain data were collected and have been filed with the directors in the shape of a preliminary report. The report is based on a connecting canal 17 miles in length, part of which would be the U. S. Reclamation Service canal from Laguna Dam to Siphon Drop (enlarged to 10,500 sec.-ft. capacity) and the remainder a newly constructed canal with a capacity of 8000 second-feet.

The excavation required for such a connection, Mr. Clarke estimates, would total approximately 7,187,200 cu.yd. Increasing the capacity of the Reclamation Service canal would involve the handling of 1,586,000 cu.yd. of earth, 2,267,000 cu.yd. of hardpan and 656,800 cu.yd. of rock. The new canal construction would require the removal of about 898,800 cu.yd. of earth and 1,758,000 cu.yd. of hardpan.

In addition to the excavation there would of course also be necessary alterations to the dam, including headworks and provision for settling basins. The preliminary report prepared by Mr. Clarke is limited to the canal work and does not include an estimate of the amount or cost of reconstruction at the dam.

Buffalo Water-Waste Survey Ordered by Council

A complete water-waste survey of Buffalo, N. Y., at a cost of $44,000, has been ordered by the city council. A partial survey by the Pitometer Co., New York City, indicated that by covering the whole city an expenditure of $80,000 in coal and $40,000 in wages could be saved.

Floods Cause Trouble in Seattle

Floods and washouts at and near Seattle caused serious interruption to traffic for a period beginning Dec. 27. On Jan. 9 railway traffic officials reported that considerable time must elapse before normal service could be established. Much damage was done to county highways and bridges.

Garbage of Three More Cities To Be Fed to Hogs

Under a three-year contract awarded about Jan. 15 to the Reservoir Heights Stock Ranch, Inc., all the garbage collected by the City of Minneapolis will be fed to hogs. The city will receive $1.26 per ton for the garbage delivered at a central loading station instead of having to haul it to the city refuse incinerator and burn it, as has been done for a number of years past. The garbage will be weighed by the city weigher.

The garbage-collection tanks will be placed by the city f.o.b. cars at the Soo Line Railway tracks at the central loading station, or else on contractors' wagons at the same point. The contractor must remove all garbage within 12 hours from the time of its delivery to him by the city. The collection tanks are to be cleansed and returned undamaged to the central loading station on the day following their removal from that point. The contractor must keep in a sanitary condition the central loading station, and also the routes along which the collected garbage is hauled.

The contract includes all market garbage and refuse (excepting feathers) and includes the paper in which the garbage of Minneapolis has been wrapped by householders for some years past, together with various household wastes that must be expected in wrapped garbage.

Under two earlier calls for bids the city was offered first $1.16 and then $1.25 a ton. The contract specifications, which were drawn some time ago, stated that in 1916 the city collected 24,000 tons of garbage, the minimum being 1462 tons in February and the maximum being 2933 tons in September.

After considerable discussion and the reception of bids for a 10-year contract for garbage disposal by feeding to hogs or by reduction, the City of South Bend, Ind., has accepted a proposal from a contractor who will pay the city $1 a ton for garbage collected and delivered to the city incinerator, which has a very central location. The decision in favor of disposal by feeding to hogs was reached in accord with a recommendation by Samuel A. Greeley, consulting sanitary engineer, Chicago.

Harrisburg, Penn., has let a 63-month contract for garbage collection and disposal at $2000 per month. The garbage will be fed to hogs. Heretofore it has been reduced.

Engineers of Tests and Draftsmen Wanted for Ordnance Department

Among the several thousand civilian workers needed urgently for the ordnance department of the Army, the U. S. Civil Service Commission announces, are 200 engineers of tests of ordnance material, from $1500 to $2400 a year; 200 assistant engineers of such test, from $1000 to $1500 a year; 500 mechanical draftsmen, from $800 to $1800 a year, and 50 gage designers, from $2000 to $3000 a year.

The salaries named are the usual salaries at entrance. Higher or lower initial salaries may be paid in exceptional cases. Further information may be obtained from the representative of the Civil Service Commission at the post-office or custom house in any city, or from the Commission in Washington.

Charter Granted to New York Chapter, American Association of Engineers

The New York Chapter of the American Association of Engineers was established on Wednesday evening, Jan. 16, at the Hotel McAlpin, when the charter granted by the national organization was formally presented by President Edmund T. Perkins. The keynote of the meeting was sounded by Mr. Perkins, the principal speaker, with the subject, "The Engineer's Relation to Society." He urged the men to broaden their social and civic activities and to pay more attention to the human equation in engineering. Alexander Potter complimented the association on its national success with the problems relating to the human and business side of the engineering profession. A. H. Krom, general secretary of the A. A. E., gave a summary of the activities of the national organization and urged the members to promote the work and coöperate with all technical societies as well as to acquaint engineers with the fact that this is a business organization in a field of its own and which conflicts with none. E. J. Mehren, editor of *Engineering News-Record;* S. J. Stone, A. C. Davis and others put forward valuable suggestions during the discussion. The New York office is at 220 West 42nd St., and the officers are R. H. Vanderbrook, chairman, and I. L. Birne, secretary.

Education Association Meeting

The Vocational Education Association of the Middle West will hold its fourth annual convention in Chicago at the Morrison Hotel, Jan. 24-26. A wide variety of topics.

Concrete Institute Meeting Postponed

On account of the congestion in the railways, particularly the difficulty of travel to and from Chicago, the Board of Direction of the American Concrete Institute on Jan. 16 decided to postpone the annual convention of the Institute until June 24-26, 1918, at Atlantic City. The convention had already been arranged to be held in Chicago Feb. 7-9, and a program was off the press. This program, together with preprints of papers and committee reports, will be sent very soon to all members of the Institute in the hope that written discussion will be made available for presentation at the June meeting. By that time, it is expected that railway travel difficulties will have eased up considerably. Certainly they will not be subject to the present inconveniences due to weather. The meeting at Atlantic City is coincident with and just before the meeting of the American Society for Testing Materials, which has always been attended by a number of members of the American Concrete Institute.

Meeting of National Chamber of Commerce

The Chamber of Commerce of the United States of America will hold its sixth annual meeting Apr. 10-12, in Chicago.

The headquarters for the board of directors and committees will be located at the Congress Hotel. The sessions of the annual meeting will be held in the auditorium.

The Aldred Lectures on Engineering Practice

The first of the 1918 J. E. Aldred lectures on engineering practice at the Johns Hopkins University, department of engineering, Baltimore, Md., was delivered on Wednesday, Jan. 16. The remaining lectures of the course will be delivered on Wednesday evenings until Mar. 20. There will be none on Feb. 6.

The course of lectures is one feature of a general plan, made possible by Mr. Aldred's gift, for furthering and improving undergraduate instruction in the methods and problems of the practice of engineering. The lectures will deal, therefore, with the practical phases of engineering problems, rather than with theory. They are not expected to discuss new and striking applications as much as to deal with everyday working methods of design, construction and operation.

Since the lectures are planned espe cially for undergraduate students, they will presuppose an elementary rather than an extensive knowledge of underlying theory, and will lay special stress on the tangible and obvious fea tures and principles of practical engineering of the present day.

Maj. Gen. William M. Black, chief of engineers, U. S. Army, will deliver the Jan. 30 lecture. His subject will be "The Relation Between Civil Engineering and Military Engineering." On Feb. 13 Arthur N. Johnson, consulting highway engineer, Portland Cement Association, Chicago, will lecture on "The Development of Concrete Road Construction." The lecture of Mar. 20 will be on "The Control of Stream Pollution," and the speaker will be Earle B. Phelps, Hygienic Laboratory, American Public Health Service, Washington.

The remaining six lectures of the present course are devoted to topics that interest the chemical and mechanical engineer rather than the civil engineer.

Early Settlement of Chicago Drainage Canal Suit Possible

By a unanimous vote the trustees of the Sanitary District of Chicago have offered to contribute $475,000 to the Federal Government for weirs to maintain the levels of the Great Lakes. To become effective the offer must be approved by Congress. The proposition is based on the condition that its acceptance will terminate the controversy over the amount of water to be withdrawn from Lake Michigan and will concede the district's "right to withdraw water as required by the Illinois statutes to the ultimate maximum amount of 12,000 cu.ft. per second."

Of the amount offered $150,000 would be required to build submerged weirs, 4.2 ft. high, in the Niagara River near Squaw Island, and the remainder for submerged weirs, 5 to 6 ft. high, in the St. Clair River three miles below the mouth of Black River at Port Huron. The proposition is in accordance with recommendations made Aug. 15, 1913, by a board of engineers for rivers and harbors headed by Gen. William M. Black, then colonel, Corps of Engineers, and now Chief of Engineers, U. S. Army. It was the opinion of the board that compensation by fixed contraction affords the cheapest and most satisfactory method of preserving the lake levels. The report recommended in substance that no objection be made to the further withdrawal of water from Lake Michigan at Chicago provided the necessary funds were placed at the disposal of the Secretary of War. A further recommendation was that Congress should fix definitely the total volume of water to be diverted beyond the existing diversion.

The proposal would seem to answer all reasonable objections from navigation and shipping interests, which have had little ground for complaint in recent years because the levels have been higher than for many years previous to the opening of the main drainage channel. As to the power interests at Niagara Falls, it is the opinion of competent attorneys that the diversions provided for in the treaty with Canada, which fixes the Canadian rights, to greater amounts than those of the United States, was evidence that the withdrawal at Chicago was taken into acount in drafting the treaty.

Construction Regiment of Engineers Now Being Recruited

There is now being formed at Camp Devens, Ayer, Mass., under the command of Col. Mark Brooke, Corps of Engineers, U. S. Army, a regiment of engineers for general construction work in France. For this unit all classes of skilled and unskilled labor are required. Among the different kinds of workmen desired are bridge, house and form carpenters, structural steel men, reinforcing steel setters, engineers, firemen, mechanics, machinists, steamfitters, blacksmiths, miners, riggers, derrick men, piledriver operators, concrete laborers, construction superintendents and foremen, civil and mechanical engineers, clerks, stenographers, timekeepers, paymasters, storekeepers and supplymen—in fact, every kind of worker usually engaged on construction jobs.

Men of special qualifications will be given noncommissioned rank up to the senior grade of master engineer. As soon as the regiment is filled and the equipment shipped, the men will leave for France. Men of draft age may join by applying to headquarters, 33rd Engineers, Camp Devens, Ayer, Mass., by mail, stating age, address, occupation, draft status and number, and number of local board, signifying their desire to volunteer for immediate service in the regiment. Men not in the draft, between 31 and 41, may enlist at the nearest army recruiting station, specifying their enlisting for service in the 33rd Engineers. It is entirely a volunteer regiment.

Consumers Must Install Water Meters at Cincinnati

Acting under a plan officially adopted last December, which provides that all water must be supplied through meters by Jan. 1, 1920, Cincinnati, Ohio, has been divided into six districts and the consumers in the first district are now receiving instructions to have meters installed before July 1, 1918. It appears that the full adoption of the plan is to be hastened, since it is reported that orders will be sent to the other five districts requiring the installation of meters before the first of August, 1918, and so on until the whole city is covered before Dec. 1 of the present year. Altogether about 18,000 consumers are said to be affected. Charles S. Hornberger is director of public service of Cincinnati and J. A. Hiller is general superintendent of water-works. A 25% increase in both meter and flat rates went into effect in Cincinnati on Jan. 1.

Wood Pipe Laid in Alkali Soil

Experiences with wood pipe laid in alkali soil are desired by J. W. Wisda, city engineer, Rawlins, Wyo., who states that the use of such pipe for a gravity water-supply is under consideration by his city.

Orders Issued Reorganizing the Alaska Road Commission

Brig. Gen. W. P. Richardson, National Army, was recently relieved from further duty with the Board of Road Commissioners for Alaska, and First Lieut. Sidney L. Carter, of the Engineer Reserve Corps, was assigned to active duty, effective Dec. 26, 1917. The latter was detailed for duty as a member of the Board of Road Commissioners for Alaska and as secretary and disbursing officer of the Board, relieving Capt. John Zug, Engineer Reserve Corps, of this duty. Captain Zug, in addition to his other duties, will aid in the supervision of the work of construction in the field as assistant engineer officer of the Board of Road Commissioners for Alaska.

Capt. William H. Waugh, Engineer Reserve Corps, in addition to his duties as engineer officer of the Board of Road Commissioners for Alaska, will serve as president thereof, discharging the duties of that office as prescribed in the orders of the War Department of Feb. 15, 1913.

These orders will govern the operations of the board, except that all correspondence and business from the board to the War Department will be submitted to the Chief of Engineers of the Army, who will exercise general supervision of the work of the board.

Federal Civil Service Examinations

The U. S. Civil Service Commission has announced open competitive examinations for the following positions: Copyist, topographic draftsmen, Geological Survey, for which examination application may be made at any time; apprentice draftsman and photographer, application to be made at the Bureau of Mines, Washington, by Feb. 6. Full information and application blanks may be obtained by addressing the U. S. Civil Service Commission at Washington, or the Civil Service District Secretary at Boston, New York, Philadelphia, Atlanta, Cincinnati, Chicago, St. Paul, St. Louis, New Orleans, Seattle or San Francisco.

Rapid-Transit Studies Begun in Cleveland

The first session of Cleveland's new rapid-transit commission was held recently. C. A. Otis is chairman, and Street Railway Commissioner Sanders is a member. The work of drawing up plans has already been started in the office of City Engineer Hoffmann.

Engineer Gets Twenty-Year Contract—Without Pay

The City Commission of Trenton, N. J., recently adopted a resolution in accordance with an agreement between it and the Public Service Railway Co. designed to safeguard the underground pipes of the city from electrolysis. The company has agreed to install and maintain "an electrolytic mitigation system under the direction, supervision and control of E. E. Brownell, consulting electrical engineer, as the representative of the city," with the understanding that Mr. Brownell is to be engaged by the city for a term of twenty years "without cost to the city."

Los Angeles County Flood-Control Bonds Validated

The decision of the California State Supreme Court validating the Los Angeles County flood-control bonds has been announced. Pending the announcement of the court in this matter, the county flood control engineers have not commenced any actual construction and the activities of the engineering department have been limited to surveys, plans and specifications and estimates. It has been stated, however, that work would be commenced as soon as a favorable decision was announced. In addition to the $4,450,000 in bonds voted by the county, there is also an appropriation of over $1,080,000 by the Federal Government and a like amount from the state, bringing the total funds released by this court decision up to $6,610,000.

Government Needs Ship Draftsmen

The Federal Civil Service Commission is urging heads of colleges and technical schools to give intensive training in naval architecture during the coming spring to senior students, and also urges qualified architectural, mechanical and structural steel draftsmen to enter the Government service as ship draftsmen. There is a dearth of ship draftsmen, the commission asserts, to carry out the Government's shipbuilding programs.

Voted To Pay for San Francisco Refuse Destructor

Upon the recommendation of the city attorney of San Francisco, the Board of Supervisors of the city voted unanimously on Jan. 7 to pay the judgment of $185,650 against the city secured some time ago by the Destructor Co. of New York City, in a suit brought to compel the city to pay for the destructor which the company had built for San Francisco. The destructor has remained unused in the hands of the contractor.

A. R. E. A. Men in Military Service Exempted from Dues

The American Railway Engineering Association is included among the technical societies that have exempted from dues for the duration of the war all members while in actual military service. The board of direction so voted Nov. 23, 1917. Such members will retain all the privileges of the association and will receive its publications upon application when they return from their military duties.

Michigan To Have Short Course in Highway Engineering

Following the general plan of the past three years, the University of Michigan announces that its fourth short course in highway engineering will be given at the university in Ann Arbor during the week of Feb. 25 to Mar. 1. The course will be a continuation of work done in the past three years, but it will be so arranged that those coming for the first time will not be seriously handicapped. The instruction will be given from the viewpoint of road conditions in Michigan for the special benefit of highway commissioners, highway engineers, contractors and others interested in the construction and maintenance of roads. One day will be set aside for the discussion of the effect of the war on road construction and maintenance, and in addition the subject of finance will be taken up, and discussions of the policy to be pursued in the administration of roads particularly during the war will be encouraged.

The instruction will be under the supervision of the engineering faculty and men in the employ of the Michigan State Highway Department. Supplementing these will be lectures by Nelson P. Lewis, chief engineer of the Board of Estimate and Apportionment, City of New York; A. D. Williams, chairman of the West Virginia State Highway Commission; John H. Mullen, engineer of roads for the Minnesota State Highway Commission; C. J. Bennett, state highway commissioner of Connecticut; R. D. Chapin, chairman of the Highways Transport Committee of the Council of National Defense, and Frank F. Rogers, state highway commissioner of Michigan. No charge is made for the course, which will be open without examination to anyone interested.

Better Health Protection for Chattanooga

In line with the efforts of Federal health authorities to improve health conditions in the vicinity of army camps, Dr. C. P. Knight has recommended an appropriation of $25,000 a year for health-protective work in Chattanooga. The recommendation includes a full-time health officer, who must be a graduate in medicine with three years' experience in health work, with a salary not to exceed $3000, and four sanitary inspectors at $100 a month each. The mayor of Chattanooga and the Chamber of Commerce are said to regard the appropriation with favor.

First Project Manager Appointed by Water Users

In a "Personal" note *Engineering News-Record* of Dec. 20, p. 1178, said that W. R. Elliott "is the first project manager to be appointed by the water users themselves on any project in the

United States." This is an error; the first project manager appointed by the water users of a project built by the Reclamation Service is A. B. Brown, manager of the North Side gravity unit of the Minidoka project. Also, Mr. Elliott was not formerly a supervising engineer in the Reclamation Service, as stated, but an electrical assistant on the Salt River Project.

Michigan Has $4,000,000 for Road Construction in 1918

During the year 1918 there will be available over $4,000,000 for highway improvements in the various counties of Michigan. This amount will be raised entirely by the counties in the form of taxes. In addition to this there is available a state-reward and automobile-tax fund which amounts to nearly $2,000,000, and the Federal-aid fund, amounting approximately to $500,000.

Providing that railroad cars are available, many important links in the trunk-line highway system of the state will be filled in. However, if railroad equipment cannot be assigned to highway work, it is the intention of the Highway Department to go ahead with the work as far as it is possible to do so by the use of auto trucks and available local material. Several of the routes are being rushed on account of their military importance. One, between Detroit and Monroe, on the Toledo road, is a very important connection between Detroit and the East, and will carry much freight between this point and the seaboard.

Waterfront at Corpus Christi, Texas, To Be Improved

A bond issue of $600,000 for waterfront improvements has been carried at Corpus Christi, Tex., by a vote of 395 to 9. Final plans have not been adopted, but the general scheme is to construct a short protection or seawall which will secure the city against damage from wind and wave action. Incidentally, this improvement will furnish lagoons and harbors for small craft, and also give an opportunity for development of the bay front with drives and parks. When the work will be commenced is uncertain, and it may be several months before the city is ready to advertise for bids. The condition of the bond market, the state of the labor supply and the difficulty of obtaining material are all unfavorable to an early start. The general plans have been prepared by Hubert A. Stevens, city engineer.

Buffalo May Build Municipal Hydro-Electric Plant

An appropriation of $10,000 for employing an engineer to select a site and prepare plans for a municipally-owned or controlled hydro-electric plant has been made by the city council or commission of Buffalo, N. Y., at the request of Commissioner Heald.

Purdue University Offers Special Course in Roads

An announcement has been issued that the department of highway engineering at Purdue University will offer a short course of illustrated lectures, laboratory observation and conferences upon general road subjects, for three days, from Jan. 29 to Jan. 31. The State Highway Commission will be in attendance and has offered to cooperate in every way to promote the interests of the schoool. Furthermore, the State Council of Defense will be asked to attend and discuss Priority Order No. 2.

Request has been made upon the State Board of Accounts to pass upon the legality of the desire of the Highway Commission to allow time and carfare to every county highway superintendent while in attendance at this special school. While no definite decision has been rendered as yet upon this point, it is thought that the good results from previous schools of this sort held by Purdue University will insure a large attendance in any event.

Shipping Board Increases Its Housing Program

The U. S. Shipping Board has made several appropriations for additional housing facilities in shipyards, although the total amounts are very much lower than those asked for in the current appropriation bills before Congress. For workers at Newport News, Va., $1,200,000 has been assigned, but no announcement has been made as to the methods of administering the funds or the relation of the private yards there to the houses when completed. Additional appropriations have also been made for the Government yards, but amounts and details are not specified. In fact, while there is undoubtedly great activity in shipyard housing, the whole matter is surrounded with a secrecy characteristic of a good deal of the Shipping Board's work.

PERSONAL NOTES

H. T. MEHLER, until recently district engineer in the construction department of the Southern Ry. at Lexington, Ky., has been assigned to other duties and HORACE STRINGFELLOW, who has been assistant engineer in the same department, has been promoted to succeed him.

ROBERT L. FOX, formerly of Johnstown, Penn., is now City Engineer of Bethlehem, Pennsylvania.

HENRY W. TROELSCH, formerly of Bala, Penn., is now with the American Bridge Co., New York City.

WILBUR H. WINANS, who was until recently with R. WINTHROP PRATT, consulting engineer, Barberton, Ohio, is now with the valuation department of the Baltimore & Ohio R.R., at Cincinnati.

J. L. CUMMINGS, who is now acting bridge engineer of the Mobile & Ohio R.R. at Mobile, has been until recently engineer of the St. Louis division of the same road.

MAJ. C. J. TAYLOR, until recently assistant to District Engineer COL. HEUER, San Francisco, Calif., has been appointed Western Department Engineer by the War Department to succeed LIEUT. COL. RICHARD PARK.

C. LOUIS ZULL recently resigned his position with the Foundation Co., on its work in Cincinnati, to become connected with the Miami Conservancy District, Dayton, Ohio.

JAMES M. HOMER has been appointed water commissioner of the city of Olean, New York, and GEORGE H. LUTHER has been made commissioner of public works of the same city.

WILLIAM E. WALSH has been appointed superintendent of the bureau of buildings, Borough of Manhattan, New York City. He succeeds ALFRED LUDWIG. Mr. Walsh has been a building constructor in New York City for the past 21 years.

B. H. WAIT has been appointed district engineer for the Portland Cement Association at New York City. Mr. Wait is a graduate of Cornell University, 1902, and has been engaged for a number of years in highway work in New York State. More recently he has been division engineer with headquarters at Poughkeepsie.

W. F. MCDADE has resigned as division engineer of the Southern Ry., in Mississippi, with headquarters at Columbus, and has been succeeded by C. U. IRVINE.

DAVID A. DECKER has severed his connection with GILBERT C. WHITE, consulting engineer at Durham, N. C., to become assistant city engineer of Norfolk, Va. Mr. Decker served in a similar position for six years prior to March of last year, when he resigned to become associated with Mr. White, but was recalled by the City of Norfolk to take charge of additional water-supply developments.

W. E. BURKHALTER has been appointed acting division engineer of the St. Louis Division of the Mobile & Ohio R.R., with headquarters at Murphysboro, Illinois.

T. HOWARD BARNES has resigned as consulting engineer for the United Fruit Co. and that office has been abolished. During the past 12 years Mr. Barnes has designed and conducted the construction of many of the important works of the company. He has collaborated in the design of sanitary municipal improvements for the republics of Panama, Costa Rica and Guatemala, and is well known in most of the Central American republics and in Cuba. He will remain in practice as consulting engineer.

FRANK C. WARNER has been appointed U. S. district engineer for the Wilmington, Del., engineering district, in succession to LIEUT. COL. MARK BROOKE, Corps of Engineers, U. S. Army, who has been transferred to the National Army and placed in command of the 330th Regiment of Engineers, at Camp Devens, Ayer, Massachusetts.

R. E. CHANDLER, professor in the mechanical engineering department of the University of Florida, has been elected president of the Florida Engineering Society, to serve for the ensuing year.

MELVILLE DOZIER, JR., consulting and executive engineer, of San Francisco, has been appointed general manager of the California State Reclamation Board. The appointment was made at a meeting of the board in Sacramento, on Jan. 4. This position was created by the last legislature, but was unfilled until Mr. Dozier's appointment. He was formerly assistant general manager of the Northern Electric Ry. Company.

W. A. GROVE has resigned as plant civil engineer to the B. F. Goodrich Co., Akron, Ohio, to become Chicago manager for Gardner Williams consulting engineer, Chicago.

FORD, BACON & DAVIS, engineers, New York, announce the formation of the FORD, BACON & DAVIS CORPORATION, organized for the purpose of conducting a general contracting business, with particular reference to industrial, public utility and power plants, steam and street railroads. The corporation announces that in effect this means the continuance in corporate form of the construction work which heretofore has been handled by the firm direct.

C. H. PURCELL, chief bridge engineer for the Oregon State Highway Department, has resigned to accept a position with the Government as bridge engineer under L. C. HEWES, district bridge engineer, with headquarters at Portland, Oregon.

LAMAR COBB, former state engineer of Arizona, has been reappointed by Governor Hunt to succeed THOMAS MADDOCK, who recently resigned.

HORACE H. HULL has been elected city engineer of Memphis, Tenn., to succeed J. H. WEATHERFORD, who has resigned to engage in consulting practice in Memphis.

M. G. LONGWELL, resident engineer of the Union Railway Co., Memphis, Tenn., has accepted the position as engineer maintenance-of-way, Wabash R.R., at Montpelier, Ohio.

WILLIAM J. HENRY, JR., formerly highway engineer, New York State Highway Department and Barge Canal Office, Albany, N. Y., has been commissioned a lieutenant in the Aviation Section Signal Corps and is now at the Aviation Camp, Morrison, Virginia.

OTIS L. MCINTYRE, who was with the U. S. Reclamation Service as assistant engineer for a number of years and more recently has been superintendent of the El Paso Foundry and Machine Co., El Paso, Tex., expects to leave El Paso shortly and become connected with the Cerro de Pasco La Fundicion, Peru, as superintendent of machinery.

K. G. WILLIAMS, assistant engineer, Rock Island Ry., at Memphis, Tenn., has been appointed resident engineer, Union Ry., at Memphis. He will continue to serve as engineer for the Rock Island Ry., the Arkansas & Memphis Railway Bridge and Terminal Co., and the American Bauxite Company.

HERBERT STANLEY BEAR, Columbus, Ohio, HUGO CARL FISCHER, New Bedford, Ohio, and GEORGE W. HORSLY, Cleveland, Ohio, have been appointed assistant civil engineers in the Navy.

HORACE G. BYERS, professor of chemistry at the University of Washington, is now a captain in the 30th Engineers, popularly known as the "gas and flame regiment."

W. G. PETERS has been appointed city engineer, superintendent of water, and building and plumbing inspector of Chehalis, Washington.

FRANK D. GORE, county engineer of Kitsap County, at Port Orchard, Wash., has enlisted in the Aviation Corps. He qualified as a flyer at San Diego, California.

EUGENE B. FULTON, of the Texas Construction Co., architects and engineers, San Antonio, Tex., is now a sergeant in the 23d Regiment of Engineers (Highway Regiment).

RUDOLPH WELCKER has given up his practice at Springfield, Mass., to become resident supervising engineer of the U. S. Navy, Department of Yards and Docks, in charge of the construction of ordnance and shipbuilding plants for the district of Baltimore.

FRANK H. MCGRAW has been appointed general superintendent of construction of Westinghouse Church Kerr, New York. Mr. McGraw has been with the organization for 14 years and has been in charge of the Westinghouse Electric job at Essington since construction commenced. Previously he handled a great deal of heavy construction, including the Communipaw locomotive terminal of the Central R.R. of New Jersey, the West Springfield shops of the Boston & Albany R.R., the Hotel Nassau, the Pittsburgh Terminal Co., and other large projects. Mr. McGraw will retain active charge of the Essington job until it is complete.

HERBERT W. BRADLEY, president of the Newton A. K. Bugbee Co., Inc., engineers and contractors, Trenton, N. J., has been commissioned by Governor Edge a captain in the Ordnance Department of the New Jersey State Militia and is now a member of the staff of Quartermaster General Murray.

EDWARD STUART, who went to Servia in 1915 as sanitary engineer of the American Red Cross Sanitary Commission, and was later appointed director of the Commission, has gone to Guatemala as sanitary engineer for the American Red Cross, to assist in preventing the spread of epidemics in the region of the recent disaster.

GEORGE N. HATFIELD, formerly road engineer of St. John, N. B., has been appointed to the vacancy created by the death of William Murdoch, city engineer of St. John.

JOHN F. COLEMAN, consulting engineer, New Orleans, La., has become chief engineer for the shipyards being constructed by the Tennessee Coal and Iron Co., at Mobile. His first task will be the construction of a village to house 5000 workmen.

MAJ. WILLIAM A. STARRETT, Engineer Reserve Corps, has been assigned to duty as contracting officer for the War Industries Board, United States Food Administration and the Ordnance Department.

LIEUTENANT COLONELS M. C. TYLER and W. H. ROSE, Corps of Engineers, U. S. Army, have been promoted to the rank of colonel and MAJORS F. C. HARRINGTON, W. H. SAGE, JR., and E. H. MARKS have become lieutenant colonels.

LIEUT. COL. R. R. RAYMOND, Corps of Engineers, U. S. Army, has been assigned to command the 3rd Engineers, on arrival in Honolulu, relieving COL. T. H. REES, who has been made a brigadier general.

E. C. WHITE, formerly in charge of the department of civil engineering at the New Mexico School of Mines, Socorro, N. M., is now Captain White, Engineer Officers' Reserve Corps, and is attached to the constructing quartermaster's department, Camp Beauregard, Alexandria, Louisiana.

C. A. HASKINS, engineer water and sewage division, Kansas State Board of Health, was commissioned captain in the Sanitary Corps, National Army, and ordered to Fort Oglethorpe, Ga., for training.

JOHN J. MANNING, until recently assistant engineer, Harbor and Dock Commission, Troy, N. Y., has been commissioned assistant civil engineer, U. S. N., with rank of lieutenant, junior grade, and has been ordered to Annapolis for temporary duty.

W. L. SWARTWOUT, formerly with the Harbor and Dock Commission, Troy, N. Y., is now assistant engineer with the American International Shipbuilding Corporation, Philadelphia.

INDUSTRIAL NEWS AND COMMENT

ABOUT MANUFACTURERS WHO SERVE ENGINEERS AND CONTRACTORS

Industry Halts at the Government's Command

List of Exemptions Omits Many Plants Engaged on War Work, but Compliance Is Prompt and Cheerful

Like an army, at the call of the commander, American industry in the vast territory east of the Mississippi River halted Friday in response to the five-day closing order of Fuel Administrator Garfield. Those plants engaged on work most urgently needed for the war remained in operation by special order of the Government. Few others kept working. Most closed without question and without urging that the Government give heed to the fact that they were engaged upon work that was essential to the progress of the war. In many of these cases no protest asking for exemption was made, although from 80% to 90% of the plant production was going to be used for military purposes.

The steel industries were as a rule instructed by the Government to continue in operation. Many of these were working upon munitions, ordnance or shipbuilding and work intimately identified with these branches. In consequence, many of the large plants in Pittsburgh, Philadelphia and the Great Lakes cities were operating as usual.

Nearly a Thousand Plants In The Exempted Industries

The exempted list numbered nearly a thousand plants in diverse lines of industry. Included among them were:

For the manufacture of important forgings:
Bethlehem Steel Company, South Bethlehem, Penn.
Midvale Steel Co., Nicetown, Penn.
Hydraulic Pressed Steel Co., Cleveland.
American Car and Foundry Co., Detroit.

For the manufacture of war essentials needed immediately:
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Burks Electric Co., Erie, Penn.
Electric Machinery Co., Minneapolis, Minn.
General Electric Co., Schenectady, N. Y.
Goodman Mfg. Chicago.
Jeffrey Mfg. Co., Columbus.
Pittsburgh Transformer Co., Pittsburgh.
Reliance Electric & Engineering Co., Cleveland.
Triumph Elect. Co., Cincinnati.
Westinghouse Elec. & Mfg. Co., East Pittsburgh.

For the manufacture of forgings for destroyers:
Camden Forge Co., Camden, N. J.
Allis-Chalmers Co., Milwaukee, Wis.
Erie Forge Co., Erie, Penn.

For the manufacture of boilers for destroyers:
Babcock & Wilcox Co., Bayonne, N. J.

For the manufacture of seamless tubes less than 1¼ in. in diameter:
National Tube Co., McKeesport, Penn.
Pittsburgh Steel Tube Co., Pittsburgh.
Pittsburgh Steel Products Co., Pittsburgh.
Ohio Seamless Steel Tube Co., Shelby, Ohio.

For the manufacture of condenser tubes ⅝ in. in diameter for destroyers:
American Brass Co., Bridgeport, Conn.
Bridgeport Brass Co., Bridgeport, Conn.

For the manufacture of locomotive for the United States Government and American railroads:
American Locomotive Co. plants at Schenectady; Dunkirk, N. Y.; Pittsburgh, Penn.; Paterson, N. J.; Richmond, Va.; Manchester, N. H.
Baldwin Locomotive Works, Philadelphia; Eddystone, Penn. and Burnham, Penn.
Lima Locomotive Corp., Lima, Ohio.
H. K. Porter Locomotive Co., Pittsburgh.

For the manufacture of products for Shipping Board:
General Electric Co. plants at Erie, Penn.; Schenectady, N. Y.; and Lynn, Mass.

For emergency fleet orders and emergency Government work:
Bethlehem Steel Co., plants at Steelton, Penn.; S. Bethlehem, Penn.; and Sparrows Point, Md.
Midvale Steel & Ordnance Co., plants at Nicetown, Penn.; Coatesville, Penn.; and Johnstown, Penn.
Lukens Steel Co., Coatesville, Penn.
Carnegie Steel Co., Pittsburgh.
Crucible Steel Co., Pittsburgh, and Harrison, N. J.
La Belle Iron Works, Steubenville, Ohio.
Otis Steel Co., Cleveland.
Lackawanna Steel Co., Buffalo.
Illinois Steel Co., Chicago.
Jones & Laughlin Steel Co., Pittsburgh.
Donner Steel Co., Buffalo.
Inland Steel Co., Indiana Harbor, Ind.
Central Steel & Iron Co., Harrisburg, Penn.
Republic Iron & Steel Co., Youngstown, Ohio.
Brier Hill Steel Co., Youngstown, Ohio.
Corrigan, McKinney & Co., Cleveland.
Forged Steel Wheel Co., Butler, Penn.
Whittaker-Glassner Co., Portsmouth, Ohio.
Youngstown Sheet & Tube Co., Youngstown, Ohio.
Alan Wood Iron & Steel Co., Conshohocken, Penn.

Among the 42 plants exempted from shutdown on account of being engaged in making aircraft and signal corps products were included:

American Steel and Wire Co., Trenton, N. J.;
Bausch & Lomb Optical Co., Rochester, N. Y.;
John A. Roebling Sons Co., Trenton, N. J.;
Western Electric Co., New York City.

They Closed Cheerfully

Inquiry among the industries serving the construction and engineering fields showed that many of them were closed in spite of the fact that they were serving the Government or the contractors on Government construction. It was evident, also, that compliance with the Government order had been cheerful and prompt. Replies of many of the manufacturers to the query regarding the effect of the closing order upon their industries showed a patriotic inclination to serve the Government's needs in any way ordered by the war administration. Here are the comments of some representative industries in response to inquiries made by *Engineering News-Record* in the New York territory:

Joseph Dixon Crucible Co., Jersey City; crucibles and graphite lubricants; J. H. Schermerhorn, vice president, said:

"Our plant closed Thursday night as ordered. We laid off from 1400 to 1600 employees. We are short of finished stock. We have Government contracts in our various departments for crucibles, lubricants for tractors, boiler graphite and other products. Practically all of our products are being used by some Government department.

"Since the war started the Government has come first with us in everything. We have given it preference over any other business. But we are not making application for special privilege to continue operation. We feel that it is our duty to obey the Government order without question."

Davis-Bournonville Co., Jersey City, City, N. J.; oxyacetylene cutting and welding apparatus; S. W. Worthan, general manager, said:

"Both our plants are closed. The Jersey City plant employs 400 men and the Elkhart, Ind., plant has 200. At the present time 80% of our work is 'war' production, either direct for the Government or for the industries engaged on war work. We have not protested or asked for exemption. We regard it as our patriotic duty to close. We feel that every loyal citizen should support the Government in prompt action when demanded. We have made careful inquiry in this manufacturing district and find that our attitude represents the general feeling of manufacturers in this section."

Lidgerwood Manufacturing Co., New York; excavating and conveying machinery; H. N. Covell, works manager of the Brooklyn plant, said:

"Our work is 100% Government work. We have simply shut down both plants at Newark and Brooklyn for the entire five-day period, and will take the matter up for discussion with the Government later, if necessary."

Ransome Concrete Machinery Co., Dunellen, N. J.; Lawrence W. Brown, sales manager, said:

"If the closing down of the industrial plants is doing any good we are glad to be contributing our share. We employ 200 men, and though they suffer from the shutdown, there was remarkably little grumbling among them."

C. R. Crouch, superintendent for the Ransome company at Dunellen, added:

"Ninety per cent. of our business is Government work, either direct or to contractors on Government jobs. We are under contract to make time deliveries on a good portion of these orders. Regardless of this we closed Thursday and will stay closed until Wednesday."

Oxweld Company, Newark and Chicago, makers of oxyacetylene cutting and welding equipment, said:

"We shut down both plants Friday and Saturday on announcement of the

Fuel Administrator's order. Late Saturday afternoon we received word from Washington that we were exempted both for the five-day period and the succeeding Monday shutdowns.

"The Newark plant uses 1000 men and the Chicago plant 1600 men. So far as we know practicaly all of these are back at work this morning."

ORDER WAS OBEYED

Word received by the *Engineering News-Record* by telegraph from many industrial centers indicated that the closing order had been generally observed. Some manufacturers announced that they had been added to the exempted list, some of these exemptions having been made after the official list was handed to the press.

In the Pittsburgh district, the *Engineering News-Record* correspondent wired, the order was received without complaint. Most of the industries in the big steel center were allowed to proceed as usual, as they are working either directly or indirectly on war materials. Carnegie, Crucible Steel, Jones & Laughlin, Pittsburgh Steel Products, National Tube, Pittsburgh Steel Tube and Westinghouse Electric all continued in operation.

Blast furnaces were kept going. They have been the "thin neck of the bottle" in Pittsburgh's output recently and the partial shutdown gave them an opportunity to meet the demands of the steel mills.

Boston, Mass.—Our plant is engaged exclusively in fabricating steel work in connection with destroyer plant at Squantum, Mass. Feeling that we are exempt from the shutdown order we have notified the Fuel Administrator that we shall keep our shops running on this work unless notified by him to stop. (Signed)

THE BOSTON BRIDGE WORKS.

Beaver Falls, Penn.—We operate our own coal mine, hence the shutdown does not affect us.

(Signed) UNION DRAWN STEEL CO.

Chicago Closes War Industries Without Complaint

Patriotic Tone Dominates Response of Industrial Managers to Closing Order

BY W. W. DE BERARD,
Western Editor, *Engineering News-Record*

Chicago, Jan. 21.—Industries supplying the civil engineer with manufactured products in the Middle West are taking the fuel shutdown order philosophically and patriotically. The saving in coal in few cases will be commensurate with the lost production, but the industries are not complaining, as they feel that Washington has the data on the situation as a whole warranting the order.

Prominent officials in various companies have been interviewed and the following are typical views:

American Well Works—Three hundred men in shops in Aurora, Ill., are idle; a few in overcoats are doing bench work. The order means a 4% reduction in annual production. War orders are so mixed up with others that it is impracticable to separate them even were there time to get exemption. Electric current to test pumps for land reclamation furthering food production has been denied. The company is glad to comply with Government requests.

C. F. Lang, president of the Lakewood Engineering Co., Cleveland, says: "The end justifies the means. I feel that a real necessity existed for relief from congestion of shipping and railroad transportation. Products representing six months' output of our company, all essential for war purposes of the Allies, are waiting for ships to transport them to Europe. The order will give a much needed relief."

George R. Brandon, vice president of the Whiting Foundry and Equipment Co., indicated that war orders for cranes did not exempt his company and the state fuel administrator would make no ruling. By the time Washington can pass on the request the five days period will be up. "On the whole," Mr. Brandon said, "the order is the best thing that could be done. Production has been so far in excess of transportation facilities recently that only one-fifteenth of our output has been shipped out, so there is no use to pile up production further. We will be satisfied if no more drastic action than this one has to be taken."

A. C. Wilby, assistant to the president, Universal Portland Cement Co., says: "Our Buffington plant is shut down completely, and one thousand of our men have been turned over to the Elgin, Joliet & Eastern R.R. to remove snow and ice from Kirk yards. I believe that cement plants generally will be closed, except possibly wet plants, which obtain clay from under water."

F. K. Copeland, president of the Sullivan Machinery Co., says: "Only coal-mining machinery department is running. This represents about 50% of the output of our plant at Claremont, N. H. While there are many irregularities, I believe that the speed in putting order into effect was warranted, for any discussion or attempt at further exemptions would have delayed the remedy until too late to be of value. Now it will help out transportation and curtail over-production. Nobody is seriously hurt. Extra work at cleaning up plants is given to helpers and common laborers."

Government Contracts No Bar to Closing in Milwaukee

Milwaukee, Wis., Jan. 21.—The shutdown was general in Milwaukee, despite the fact that many of the big industries were making equipment essential to the Government on the so-called war industries.

Pawling and Harnischfeger Co. closed down entirely for five days. They kept a small force engaged on repairs and overhauling the plant Friday and Saturday. No modification of the order was received. They report that the fuel saving is very small and hardly justified, when consideration is given to the importance of urgent Government contracts on hand.

Cutler-Hammer Co. shut down Thursday night for the full period. There is a possibility that some departments executing important naval contracts will resume Monday on exemptions. The company states that the closing order is cheerfully complied with as a war measure.

The Chain Belt Co. suspended work Friday for five days, but retained a small force for urgent maintenance and supervisory duties. The others were laid off without pay. Important contracts are being held up but the closing order is regarded as probably necessary, although not wholly advisable.

The Bucyrus Co. reports that the plant is entirely closed. A few departments are expected to resume Monday to hasten work on Government contracts.

Koehring Machine Co. stated that they had no hesitation in closing as work is rather slack because of the restriction of building operations everywhere.

Philip Koehring declared that the order was "rather unpatriotic in so far as it threw many out of employment and wages."

Cleveland Plants Shut Down Despite Important War Orders

Cleveland, Ohio, Jan. 21—Melvin Pattison, General Manager of the Brown Hoisting Machinery Co., says, "The situation was so acute that something had to be done. I believe that the people in Washington were in a better position to size up the situation and apply a remedy than were the people in this or any other section of the country.

"Traffic conditions were so bad, anyway, that is was only a question of a few days until plants would have begun to close down without any orders.

"I am not saying that the situation could not have been averted by proper methods and foresight, but I do say that it was acute, and drastic measures were absolutely necessary.

"Our works, employing twelve hundred men are idle, except for one hundred men busy unloading material and doing all possible to relieve the car shortage. Our company is engaged on government work."

Charles Lang, President of the Lakewood Engineering Co., is out of town, but sent orders that the fuel order should be complied with, both in letter and in spirit. The superintendent and other officials state that six hundred men are idle on Government work.

E. W. Kaltenbach, President of the McMyler Interstate Co., said, "We have orders to work. The fuel order will not affect us at all, consequently I am not in position to comment on it." Twelve hundred men are employed in this plant.

Edwin S. Church, President of Wellman Seaver Morgan Co., said, "We have sixteen hundred men idle, but we take it for granted that the officials in touch with the general situation know best how to deal with it. We are working on Government contracts and expect to have permission to continue work soon."

$3,250,000 Loss in Wages Is Estimated for Detroit's Industrial Workers

Detroit, Mich., Jan. 21.—Detroit industrial plants generally, except those exempted, are complying literally with the Federal Fuel Administration's closing regulations. It is estimated that 230,000 workers are idle for four days, involving loss in wages alone of more than $3,250,000.

"We are completely closed, although we have some government orders," says John G. Rummey, president of the Detroit Steel Products Company.

"We have received no reply to our request for permission to operate and were we to receive an answer now it would be too late to get the men back at work."

The company employs about 1 000 men, its government contract includes large orders for steel windows for the new shipyard buildings and for buildings added to old plants. Orders for springs for ambulances and trucks for war use are also in the plant.

"Except for the aeroplane motor department we are all shut down," says Alvan MacCauley, president Packard Motor Company, which has large government orders.

"About 7000 of our men are idle and approximately 2000 at work on the continuation of operations in the aeroplane motor department." This aeroplane work, Mr. MacCauley explained, requires the use of nearly every part of the company's enormous plant, excepting the forge and foundry departments.

"We have been working on some Government orders," says Ralph M. Dyar, secretary of the Trussed Concrete Steel Co., whose plant is located in Youngstown, Ohio. "I am not sure the closing order affects us, but I would not care to make any statement on that plan."

Industrial Works Stops and Starts Again

Bay City, Mich., Jan. 21.—Upon receipt of instructions we shut down completely immediately. We took the matter up with the Shipping Board, and after a shutdown of 24 hours were instructed to resume operations. However, by this shutdown of one day, our organization was seriously disrupted and disproportionate delay in building Government needs was caused. A shutdown of one day per week in the future would doubtless have a similar effect. Our workmen were greatly disappointed at losing time just now.

(Signed) INDUSTRIAL WORKS.

Bay City, Mich., Jan. 21.—All plants without special exemption are complying with fuel shutdown order. Plants using power from the Consumers' Power Co. are not exempted here, as 60% of that power depends on coal. Those plants exempt are working on Government material orders or they are wood-working plants using sawdust or manufacturing wood for sale as fuel.

(Signed) MICHIGAN PIPE CO.

Electric Power Keeps Wheels Turning at Niagara Falls

Niagara Falls, N. Y., Jan. 21.—Inquiry among the Niagara Falls manufacturers shows that this district is not so greatly affected by the fuel shutdown as is the case where coal is the chief or only dependence for power. Many industries report that they have so much hydro-electric power available that they are wholly unaffected except where coal has to be used for heating. It appears that the fuel crisis is likely to be used as an argument for more Niagara power in order to make this industrial center entirely independent of coal.

President John Dobbie, of the Dobbie Foundry and Machine Co., states that his company is complying with the fuel order, but has not been obliged to lay off more than 60% of the force and hopes to resume on Wednesday at full capacity. So much of the power in this plant is obtained electrically that the matter of coal supply is a somewhat minor one. The company is making goods that are needed, and so all effort will be made within the spirit of the order to keep active as far as possible. At the same time there is no thought of evading the order in any way.

NEED MORE NIAGARA POWER

D. E. Dunlap, of the International Acheson-Graphite Co., reports much in the same vein. The company's works is using so much hydro-electric power that it is easy to comply with the order without reducing operations to any great extent. There was no idea of evading the order and only such an amount of coal would be used as was necessary to keep the needed heat up. The situation brought out clearly the need for more Niagara power, and it was felt that every effort should be made to obtain the needed legislation. If the country had a liberal supply of hydro-electric power it would be in a very independent condition.

An official of the Electro-Bleaching Gas Co., makers of liquid chlorine for water purification, expressed the opinion that his output is exempt from the operation of the fuel order, though this does not excuse him from cutting down the use of coal as much as possible. In consequence, the use of coal was restricted to the amount needed to keep the works from freezing.

Some of Philadelphia's War Industries Reopen on Orders from Washington

Philadelphia, Jan. 21.—Most of Philadelphia's big iron and steel industries were deemed essential to war work and were kept in operation. Some of those which were not exempted on the first list were later notified by Washington to resume operations. Out of 400,000 men who were made idle by the coal-closing order Friday, 100,000 were returned to work.

Baldwin Locomotive Works remained in operation. An early report failed to show the name of the big locomotive plant on the exemption list. This led to inquiry on the part of the State Fuel Administrator, who discovered that Washington had notified Baldwins of their exemption but had failed to announce the fact publicly.

The J. G. Brill Co. and the Link-Belt Co. were both omitted from the exempted list. Charles Biddle, of the Brill plant, pointed out to the State Fuel Administrator that the company was working for the Ordnance Department as well as the Navy Department. The plant was permitted to remain in operation to work on the Ordnance Department contract only.

The American Bridge Co., which was ordered to close its Philadelphia plant, asked permission to start fires under the boilers Tuesday in order to have the plant ready for operation Wednesday. Permission was refused. The plant will therefore be shut down six days instead of five.

The Hess-Bright Manufacturing Co. resumed operations today, after a three days' shutdown. They promptly observed the closing order, but were notified by Washington to reopen. Eighty per cent. of their output is going to the Government.

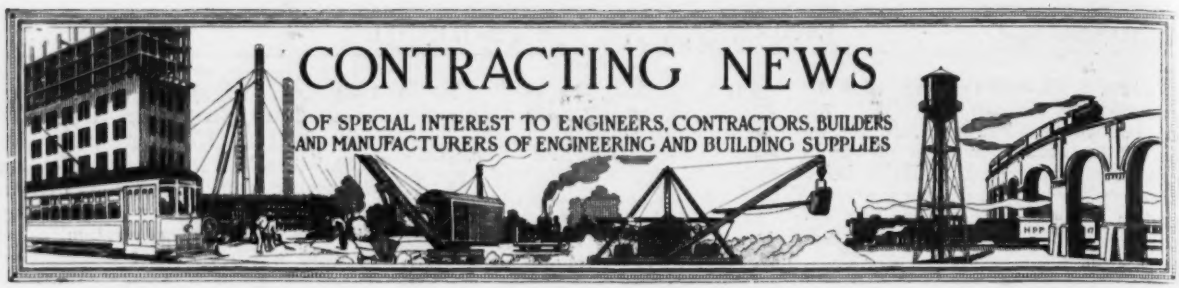
Ball Engine Co. Saves Twenty per Cent. of Fuel at Sacrifice of One Hundred per Cent. Production

Erie, Pa., Jan. 21.—The Ball Engine Company has just finished a large contract for engines for the Government, and has no Government work in the shop at present. The plant is shut down completely, in compliance with the Government order.

As five or six large plants in Erie have received exemptions from the order and are allowed to keep running and every one of them is advertising for men, some of the factories which have been compelled to close complain that they have already lost a considerable number of men.

The total saving of fuel that was effected by the shutdown of the plant was only about 20%. Normally the heating is done by means of exhaust steam, and when steam must be kept up to prevent the sprinkler system from bursting, the fuel saving is only 20%. The production loss which enables this saving is, of course, 100%.

(Signed) BALL ENGINE CO.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WATER-WORKS

Bids Close		See Eng. News-Record
Jan. 26.	Elizabeth, N. J.	Jan. 17
Jan. 28.	Columbus, O.	Jan. 17
Jan. 28.	Red Fork, Okla.	Jan. 24
Jan. 31.	Peoria, Ill.	Jan. 17
Feb. 5.	Jersey City, N. J.	Dec. 27
Feb. 7.	San Rafael, Cal.	Jan. 24
Feb. 10.	Janesville, Wis.	Jan. 24
Feb. 13.	Pine City, Minn.	Jan. 24
Feb. 14.	Wilton, N. D.	Jan. 24
Feb. 19.	Hartford, Wis.	Jan. 24

SEWERS

Jan. 31.	Marcus, Ia.	Jan. 24
Feb. 1.	Toledo, O.	Dec. 13
Feb. 5.	Phillipsburg, N. J. Adv. Jan. 3, 10, 17 and 24.	Jan. 3
Feb. 5.	Texarkana, Tex.	Jan. 17
Feb. 6.	Twin Falls, Idaho	Jan. 10
Feb. 14.	Wilton, N. D.	Jan. 24

BRIDGES

Jan. 28.	McCook, Neb.	Jan. 3
Jan. 30.	Dundee, Ill.	Jan. 17
Jan. 31.	Dyersville, Ia.	Jan. 17
Jan. 31.	Romney, W. Va.	Jan. 10
Jan. 31.	Dubuque, Ia. Adv. Jan. 24.	Jan. 24
Feb. 4.	Marshalltown, Ia.	Jan. 24
Feb. 19.	Princeton, Minn.	Jan. 24

STREETS AND ROADS

Jan. 28.	California	Jan. 17
Jan. 28.	Huntington, W. Va.	Jan. 24
Jan. 31.	Key West, Fla.	Jan. 10
Jan. 31.	Tacoma, Wash.	Jan. 24
Feb. 1.	Cincinnati, O.	Jan. 17
Feb. 4.	Sacramento, Cal.	Jan. 24
Feb. 4.	Greenfield, Ind.	Jan. 24
Feb. 4.	San Bernardino, Cal.	Jan. 24
Feb. 5.	Stockton, Cal.	Jan. 24
Feb. 5.	Tallahassee, Fla.	Jan. 17
Feb. 5.	Indiana	Jan. 17
Feb. 5.	Visalia, Cal.	Jan. 24
Feb. 5.	Ft. Pierce, Fla.	Jan. 24
Feb. 11.	Bradentown, Fla.	Jan. 24
Feb. 14.	Evening Shade, Ark.	Jan. 17
Apr. 23.	Santa Domingo, West Indies Adv. Jan. 24.	Jan. 24

EXCAVATION AND DREDGING

Jan. 29.	Walker, Minn.	Jan. 10
Jan. 29.	Sibley, Ia.	Jan. 17
Feb. 2.	Brainerd, Minn.	Jan. 24
Feb. 5.	Albany, N. Y. Adv. Jan. 17 and 24.	Jan. 17
Feb. 5.	Piggott, Ark.	Jan. 24
Feb. 5.	Yankton, S. D.	Jan. 24
Feb. 9.	Elbow Lake, Minn.	Jan. 24
Mar. 1.	Newcastle, Wyo.	Jan. 24

BUILDINGS

Jan. 28.	Prairie View, Tex.	Jan. 24
Jan. 29.	Fresno, Cal.	Jan. 17
Jan. 31.	Albany, N. Y. Adv. Jan. 17 and 24.	Jan. 17
Feb. 1.	Painesville, O.	Jan. 24
Feb. 5.	Nevada City, Cal.	Jan. 24
Feb. 5.	Hightstown, N. J.	Jan. 24
Feb. 11.	Columbus, O.	Jan. 17
Feb. 11.	Columbus, Neb.	Jan. 24
Feb. 13.	Des Moines, Ia.	Jan. 24
Feb. 15.	Duluth, Minn.	Dec. 27
Feb. 15.	North Elba, N. Y.	Jan. 24
Mar. 1.	Wassau, Wis.	Jan. 17
Mar. 8.	Rice Lake, Wis.	Jan. 17
Apr. 1.	Springfield, Mass.	Jan. 17

FEDERAL GOVERNMENT WORK

Jan. 26.	Rope, Concrete Mixers and Portable Saws — Wash., D. C.	Jan. 24
Jan. 28.	Boiler Shop—Wash., D. C.	Jan. 24
Jan. 28.	Plumbing Fixtures—Philadelphia, Pa.	Jan. 24
Jan. 28.	Post Office—Sunbury, Pa.	Dec. 6
Jan. 28.	Marine Railways—Boston, Mass.	Jan. 10
Jan. 28.	Marine Railway—Charleston, S. C.	Jan. 10
Jan. 28.	Gates—Louisville, Ky. Adv. Jan. 10, 17 and 24.	Jan. 10
Jan. 31.	Wharf—Ft. Adams, R. I. Adv. Jan. 10, 17 and 24.	Jan. 10
Feb. 1.	Dredging — New Orleans, La. Adv. Jan. 10, 17 and 24.	Jan. 10
Feb. 2.	Railroad Track Scales, etc. —Panama	Jan. 24
Feb. 4.	Dredging—Norfolk, Va.	Jan. 24
Feb. 5.	Excavators—Denver, Colo.	Dec. 27
Feb. 6.	Post Office — Pittsburgh, Pa.	Jan. 10
Feb. 9.	Wicket Irons, etc.—Louisville, Ky. Adv. Jan. 24.	Jan. 24
Feb. 11.	Dredging—New York, N. Y. Adv. Jan. 17 and 24.	Jan. 17
Feb. 11.	Piping System — Philadelphia, Pa.	Jan. 24
Feb. 11.	Electrically Driven Capstans—Washington, D. C.	Jan. 24
Feb. 11.	Power Plant Improvements —Brooklyn, N. Y.	Jan. 24
Feb. 15.	Dredging—Seattle, Wash.	Jan. 24
Feb. 25.	Gymnasium and Store House — Pearl Harbor, Hawaii	Jan. 24

MISCELLANEOUS

Jan. 29.	Waterway Improvements— West Palm Beach, Fla.	Jan. 10
Jan. 29.	Street Lighting System— New York, N. Y.	Jan. 17
Jan. 29.	Deepening Channel —Albany, N. Y.	Jan. 24
Feb. 11.	Harbor Improvement—Mobile, Ala.	Dec. 27

Where name of official is not given, inquiries should be addressed to City Clerk, County Clerk or corresponding official.

WATER-WORKS

Proposed Work

Mass., Westfield—Town plans to build storage reservoir on Granville water shed. A. Hyde, city engr.

N. J., Matawan—Boro. plans to install electric pumping machinery at water-works plant.

N. J., Netcong—City plans to build new pumping station for water system.

Pa., Glassport—City having plans prepared by L. Hudson, engr., House Bldg., Pittsburgh, for water system.

Ga., Dublin—City voted $15,000 bonds for water and sewer mains. M. J. Gutyon, supt. Noted Nov. 22.

Ga., Savannah—City plans to purchase electric pump for water department. About $7500.

Ill., Galesburg—City election soon to vote on bonds to improve water system, involving sinking deep well and purchasing pumping apparatus. F. M. Connolly, city engr.

Wis., Menomonie—City plans to improve water system by building filtration plant. About $50,000. P. Huntington, city engr.

Wis., South Milwaukee—City having plans prepared by Caldwell Eng. Co., engrs., Jacksonville, building additional pumping engine for water system.

Ia., Ft. Dodge—City plans to install filtration plant. C. H. Reynolds, city engr.

Ia., Marshalltown — City soon receives bids for 3 new boilers for pumping station. W. H. Steiner, city engr.